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Date: June 17, 2003
Refer to: RRES-GPP-03-073

TA-36 (Pajarito Canyon, Hydrogeologic Workplan, Groundwater, TA-54

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Mr. Mat Johansen
National Nuclear Security Administration
Department of Energy, MS A316
Los Alamos Site Operations
Los Alamos, NM 87545

SUBJECT: **CHARACTERIZATION WELL R-20 COMPLETION REPORTS**

Dear Mat:

Enclosed are two copies of the Characterization Well R-20 Completion Report. This report documents work completed under the Hydrological Work Plan.

If you have questions, please call me at (505) 665-4681.

Sincerely,

Charles L. Nylander

Charles Nylander, Program Manager
Groundwater Protection Program

CN/th

Enclosure: Characterization Well R-20 Completion Report (ER2003-0199/GPP-03-032)

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Remediation Program

RRES

LA-UR-03-1839
June 2003
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GPP-03-032

Characterization Well R-20 Completion Report

Los Alamos
NATIONAL LABORATORY
Los Alamos NM 87545

Produced by the Groundwater Protection Program, Risk Reduction & Environmental Stewardship Division

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List of Acronyms and Abbreviations

AITH	array induction tool, Version H
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	best management practice
CMR	combinable magnetic resonance
CNTG	compensated neutron tool, model G
COPC	chemical of potential concern
CVAA	cold vapor atomic absorption
DOT	Department of Transportation
DQO	data quality objective
DR	dual rotary
ECS	elemental capture spectroscopy
ESH	Environmental, Safety and Health
FMI	formation microimager
FSF	Field Support Facility (part of the Risk Reduction and Environmental Stewardship
GPS	global positioning system

GR	gamma radiation
hp	horsepower
HSA	hollow-stem auger
IC	ion chromatography
ICPES	inductively coupled plasma emission spectroscopy
ID	inner diameter
IRMS	isotope ratio mass spectrometry
LANL	Los Alamos National Laboratory
MDA	material disposal area
NAD 83	North American Datum, 1983
NGS	natural gamma spectroscopy
NMED	New Mexico Environment Department
NTU	nephelometric turbidity unit
OD	outer diameter
psi	pounds per square inch
PFD	phosphate-free dispersant
PVC	polyvinyl chloride
QC	quality control
RC	reverse circulation
RRES	Risk Reduction and Environmental Stewardship (Division)
SAP	sampling and analysis plan
SMO	sample management office
SSHASP	site-specific health and safety plan
SVOC	semivolatile organic compound
TA	technical area
TD	total depth
TLD	triple detector lithodensity
TKN	total Kjeldahl nitrogen
UDR	universal drill rig
UR-DTH	under-reaming down-the-hole (hammer)
VOC	volatile organic compound
WCSF	waste characterization strategy form
WGII	Washington Group International, Inc.

Metric to US Customary Unit Conversions

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

CHARACTERIZATION WELL R-20 COMPLETION REPORT

ABSTRACT

Characterization well R-20 was installed under implementation of the Los Alamos National Laboratory hydrogeologic work plan. Washington Group International, Inc., carried out drilling activities under a subcontract to Los Alamos National Laboratory (the Laboratory). The well is located east of Technical Area (TA)-18 on the south side of Pajarito Road in Pajarito Canyon. The primary purpose of this well is to provide hydrogeologic and water-quality data for regional groundwater near potential contaminant release sites at TA-54.

Hydrologic, geologic, geochemical, and geophysical information obtained during completion and subsequent sampling of well R-20 will provide data for the Laboratory hydrologic and geologic conceptual models and contribute to implementing a Laboratory-wide groundwater monitoring system. Monitoring this network of wells supports the Laboratory's Groundwater Protection Management Program Plan and will satisfy the requirements of the Pajarito Canyon work plan to characterize the regional aquifer in this area.

The R-20 borehole was drilled to a total depth of 1365 ft below ground surface using fluid-assisted and air-rotary and conventional mud-rotary drilling methods. Geologic strata encountered included alluvial sediments, the Tshirege Member of the Bandelier Tuff, deposits of the Cerro Toledo interval, ash flows and Guaje Pumice Bed of the Otowi Member of the Bandelier Tuff, Cerros del Rio lavas, Puye Formation fanglomerates and pumiceous sediments, and sediments tentatively assigned to the Santa Fe Group.

No perched zones were encountered during drilling. The regional water table was encountered at a depth of 873 ft.

Three well screens were installed in well R-20 to measure vertical pressure gradients and to provide multiple water-quality monitoring ports in the regional aquifer. One screen was placed at the top of the regional aquifer and two were placed at depth within the aquifer. Well installation was completed on September 15, 2002. Two regional aquifer water samples were collected from the developed well and submitted for analysis. Although strontium-90 was detected near the minimum detection activity level, the absence of tritium suggests that the waters have not been impacted by Laboratory releases. The completed well was equipped with a Westbay™ multiport sampling system.

Initial coring attempts prior to deep drilling were successful only to a depth of 72.5 ft below ground surface. A separate boring was drilled adjacent to R-20 after well installation to collect remaining core samples. The borehole was advanced to a depth of 436 ft and core samples were collected to characterize the vertical distribution of potential contaminants beneath Pajarito Canyon. The borehole was plugged and abandoned after coring operations were completed.

1.0 INTRODUCTION

This completion report summarizes characterization well R-20 preparation, drilling, well construction, well development, and site completion activities conducted from July 9, 2002, to March 5, 2003. Well R-20 is located on the south side of Pajarito Road in Pajarito Canyon, 1225 ft east of water supply well PM-2 at Technical Area (TA)-18 (Figure 1.0-1). The well was installed as part of the "Hydrogeologic Workplan" (LANL 1998, 59599) to support of Los Alamos National Laboratory (LANL or the Laboratory) “Groundwater Protection Management Program Plan” (LANL 1996, 70215) and to meet the requirements of the “Work Plan for Pajarito Canyon” (LANL 1998, 58820). Data collection, testing, and well-development activities for R-20 were guided by the “Sampling and Analysis Plan (SAP) for the Drilling of Characterization Well R-16, R-20, R-21, R-23, and R-32 in the Vicinity of TA-54” (LANL 2002, 73390).

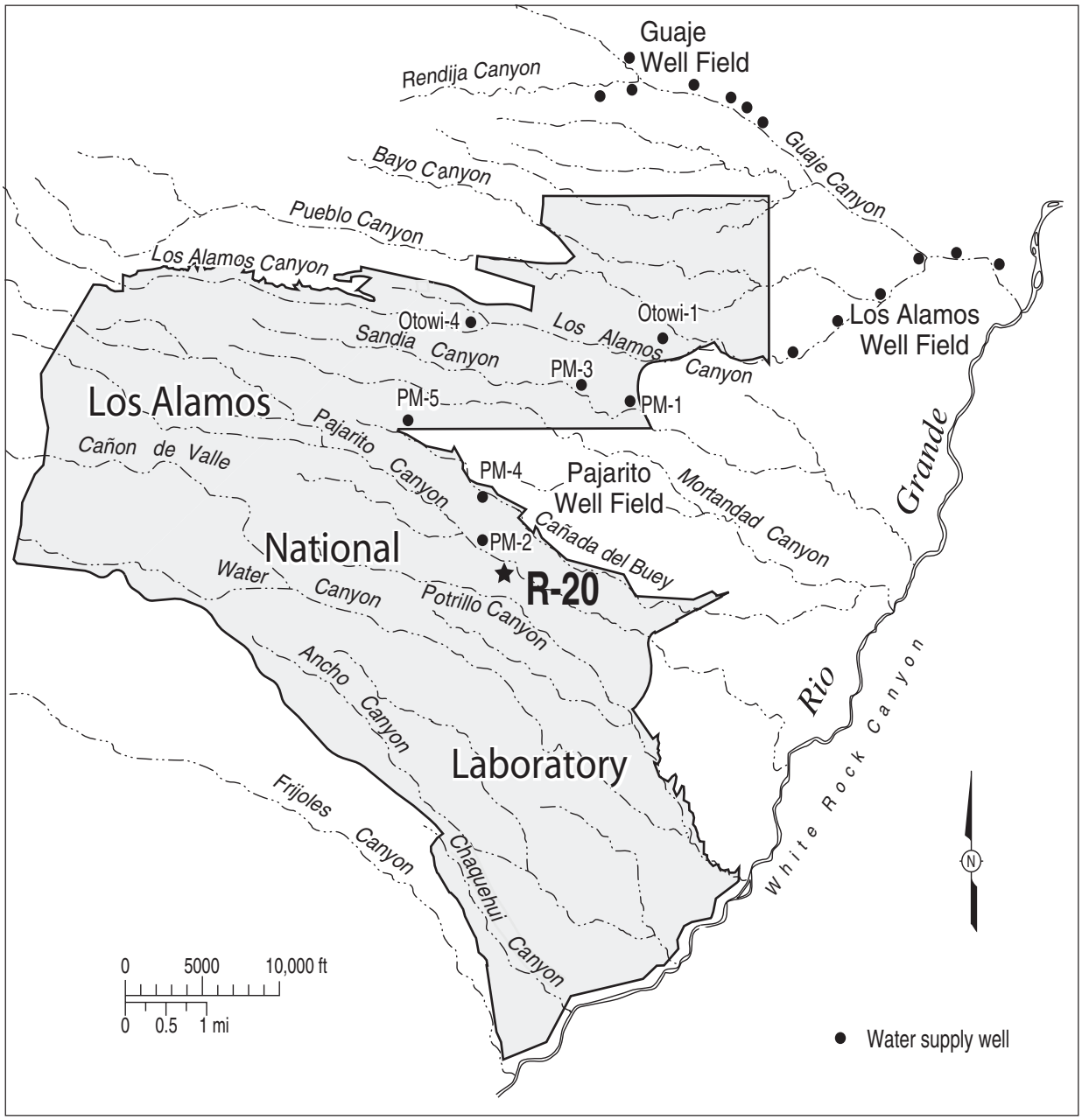


Figure 1.0-1. Location map, characterization well R-20

The project was funded by the Nuclear Weapons Infrastructure, Facilities, and Construction Program and installed by the Laboratory's Risk Reduction and Environmental Stewardship (RRES) Division. Washington Group International, Inc. (WGII), under contract to the Laboratory, was responsible for executing drilling activities.

Well R-20 will function primarily as a monitoring well between material disposal area (MDA) L at TA-54 and supply well PM-2. Well R-20 also will provide information about the extent of the capture zone at well PM-2. Water-quality, geochemical, hydrologic, and geologic data gathered during drilling and subsequent sampling will provide information about perched and regional groundwater in this part of Pajarito Canyon and the distribution of potential contaminants downgradient of Laboratory releases. These data will be used to update sitewide hydrologic and geologic conceptual models for the Laboratory.

Information presented in this report was compiled from field reports and activity summaries generated by Laboratory and subcontractor personnel. Geophysical data provided by Schlumberger, Inc. (Schlumberger) and geodetic survey results are included. This report focuses on operational activities associated with the drilling, sampling, and completion of well R-20. Detailed analysis and interpretation of geologic, geochemical, geophysical, and hydrologic data, included as part of previous well completion reports, will be discussed in separate technical documents to be prepared by the Laboratory.

2.0 PRELIMINARY ACTIVITIES

Preliminary activities at R-20 included administrative functions and site preparation. Appendix A compares these and other planned activities outlined in the R-20 SAP with actual work performed.

WGII received contractual authorization to start administrative preparatory tasks on June 6, 2002. As part of these tasks, WGII prepared a modification to existing site-specific health and safety plan (SSHASP) No. 271 to include well R-20. WGII also prepared the R-20 waste characterization strategy form (WCSF). The Laboratory prepared the sampling and analysis plan (SAP) to guide field personnel in executing R-20 field activities. The host facility, Facility Management Unit 80, signed a Facility Tenant Agreement to provide access and security control for R-20 activities.

A Readiness Review meeting was held on July 1, 2002, to discuss administrative documents, permits, agreements, and plans pertaining to the R-20 drill pad installation and drilling. The Groundwater Investigations Focus Area project leader signed the readiness review checklist on July 1, 2002, giving authorization to begin work.

K. R. Swerdfeger Construction, Inc., was subcontracted by WGII to conduct site preparation activities, including clearing and removing vegetation, modifying the access road, grading and compacting the drill pad, and constructing a lined cuttings-containment area. Site preparation began on July 9, 2002, and was completed on July 23, 2002.

The R-20 site initially was cleared of all vegetation. Construction of the drill pad involved leveling the 80- by 200-ft designated area with a grader and compacting several layers of base-course gravel. A 115-ft-long by 30-ft-wide by 14-ft-deep containment area was excavated along the south side of the drill pad and lined with a 6-mil polyethylene liner for storing drilling fluids. An 80- by 40-ft secondary fluids-containment area was constructed to accommodate three 20,000-gal. fluid-storage trailers and to store additional drilling fluids. Before the secondary containment facility was constructed, the perimeter of the area was bermed and lined with 6-mil polyethylene sheeting that overlapped the berms. The cuttings-containment area was fenced to control access. Safety barriers and signs were placed in appropriate locations. Office

and supply trailers, generators, and safety lighting equipment were moved to the site before drilling commenced.

3.0 SUMMARY OF DRILLING ACTIVITIES

Drilling activities were completed in two phases during August, September, and October 2002. Phase I drilling and core sampling was attempted by Stewart Brothers Drilling Company (Stewart Brothers) with a Failing F-10 auger rig equipped with 4.25-in.-inside diameter (ID), 9-in.-outside diameter (OD) hollow-stem augers (HSAs); the HSAs were equipped with a wire-line core retrieval system capable of collecting 3-in.-diameter by 5-ft-long core samples. Phase I drilling began on August 4, 2002. While coring through 68 ft of alluvium, the auger flights jammed several times, after coring down to only 72.5 ft below ground surface (bgs) by August 8, 2002. The Laboratory suspended coring operations until after well R-20 installation. Dynatec Drilling Company, Inc. (Dynatec), completed Phase I coring between October 16 and October 19, 2002, using a Foremost™ universal drill rig (UDR)-1000 equipped with a wire-line core retrieval system and a 5-ft-long core barrel to collect 2.5-in.-diameter core samples.

The goal of Phase I drilling was to collect continuous rock core samples for geologic characterization and to determine moisture, anion, stable isotope, radionuclide, metal, and tritium distributions in the upper section of the borehole. Planned total depth (TD) for Phase I drilling was approximately 450 ft bgs, or approximately 50 ft into the Cerros del Rio basalt. Coring was terminated at 436 ft bgs, 44 ft into the Cerros del Rio basalt.

Phase II drilling was conducted by Stewart Brothers using a Failing F-2500 drill rig and fluid-assisted air-rotary and mud-rotary drilling methods. Phase II objectives were to produce cuttings of encountered geologic formations, collect water samples from perched and regional groundwater zones and provide a borehole for geophysical measurements and well installation in the regional aquifer.

Figure 3.0-1 summarizes well data and depicts groundwater and geologic conditions encountered in well R-20. Sections 3.1 and 3.2 discuss Phase I and Phase II drilling activities, respectively, for R-20. Figure 3.0-2 summarizes the chronology of drilling and other related on-site activities.

3.1 Phase I Drilling

On August 3, 2002, Stewart Brothers mobilized the Failing F-10 drill rig and support equipment to the well R-20 site. On the following day, the borehole was advanced by HSA while attempting to core through the alluvium. At 32.5 ft bgs, the latching mechanism detached from the core barrel, leaving the core barrel in the borehole. After several unsuccessful attempts to retrieve the core barrel, Stewart Brothers moved the drill rig 10 ft to the east and started a new borehole. The offset boring was advanced to 32.5 ft, when coring resumed. Coring continued to 57.5 ft bgs on August 5, 2002, when Stewart Brothers set surface casing to seal off a shallow, saturated zone.

On August 6, 2002, Stewart Brothers reamed the second borehole to 37 ft bgs with a 12.25-in. auger bit, inserted 30 ft of 10.25-in.-ID surface casing, and pressure-grouted the casing in place. The cement was allowed to cure for 12 hr. The borehole then was reamed to 57.5 ft bgs and coring continued to 72.5 ft bgs, with poor core recovery during each interval.

Location: East of TA-18 on the south side of Pajarito Rd., east of the stream channel.

Survey coordinates (brass marker in NW corner of R-20 cement pad): x: 1637835 E y: 1759695 N (NAD 83) z: 6694.3 ft asl (NGVD 29)

Drilling: Conventional mud drilling, casing advance; air rotary core w/ wireline retrival.
R-20 Start date: 08/15/02, end date: 09/06/02.
Coring start date: 10/16/02, end date: 10/19/02

Borehole R-20 drilled to 1365 ft. bgs. (T.D.).

Data collection:
Hydrologic properties: Field hydraulic test: Constant Rate Injection Test on screen #1, screen #2, and screen #3
Cores/cuttings submitted for geochemical and contaminant characterization: (0)
Groundwater samples submitted for geochemical and contaminant characterization: (3)
Geologic properties: (12)
Mineralogy, petrography, and chemistry
Borehole logs from R-20:
Lithologic: 0-490 ft. and 785 ft.-1365 ft.
Borehole Video (LANL tool): 82-785 ft. (open hole).
Natural gamma + Induction (LANL tool): 0-80.2 ft. (cased), 80.2 ft.-785 ft. (cased).
Schlumberger Logs: 0-80.2 ft. (cased), 80.2-785 ft. (open hole): Array Induction, Litho Density, Natural Gamma, Thermal/Epithermal Neutron,Caliper, Combinable Magnetic Resonance, and Elemental Capture Sonde.
Natural Gamma (LANL tool): 0-780 ft. (cased), 780-1365 ft. (open hole).
Schlumberger Logs: 0-780 ft. (cased), 780-1365 ft. (open hole): Thermal/Epithermal Neutron, Litho Density, Micro Imager, Array Induction, and Natural Gamma.

Contaminants Detected in R-20 Water Samples: none

Well construction:
Drilling Completed: 09/06/02
Contract Geophysics: 08/26/02; 09/06/02
Well Constructed : 09/07/02-09/15/02
Well Developed : 09/15/02-12/22/02
Westbay Installed : 01/08/03-01/18/03

Casing: 4.5-in I.D. stainless steel with external couplings.

Number of Screens: 3
4.5-in I.D. pipe based, s.s. wire-wrapped with 0.010-in slots.

Screen (perforated pipe interval):
Screen #1 - 904.6 - 912.2 ft. bgs.
Screen #2 - 1147.1 - 1154.7 ft. bgs.
Screen #3 - 1328.8 - 1336.5 ft. bgs.

Well development consisted of wire brushing, bailing, chemical treatment, surging, and pumping.

Groundwater occurrence was determined for R-20 by recognition of first water produced while drilling, by borehole geophysics, and by borehole video. Static water levels were determined after the R-20 borehole was rested.

Groundwater samples collected from packed off screen intervals after well development.

Geologic contacts for R-20 were determined by examination of cuttings and interpretation of geophysical logs. Contacts may be refined by petrographic, geochemical, or mineralogic analysis of geologic samples.

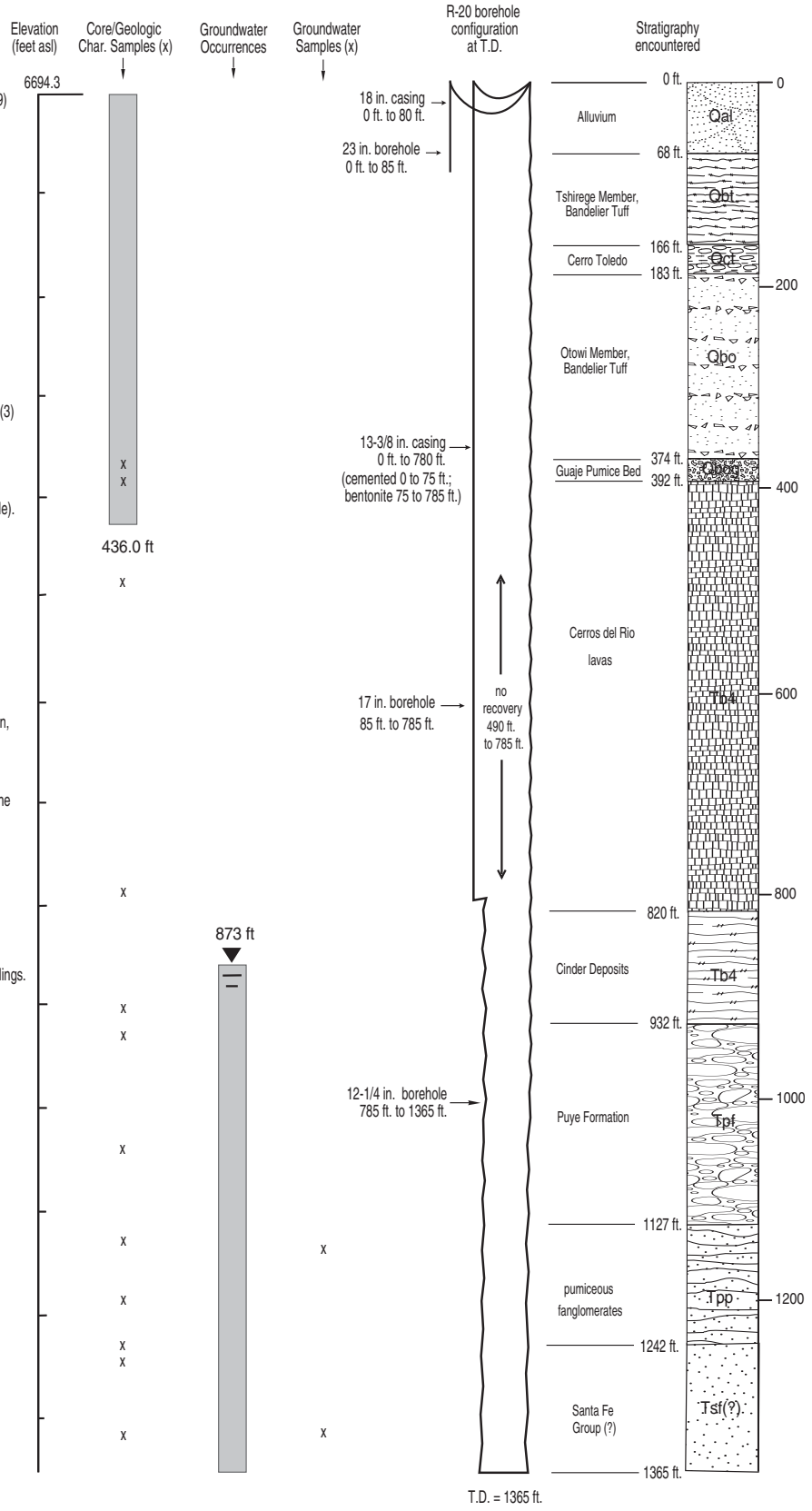


Figure 3.0-1. Well summary data sheet, characterization well R-20

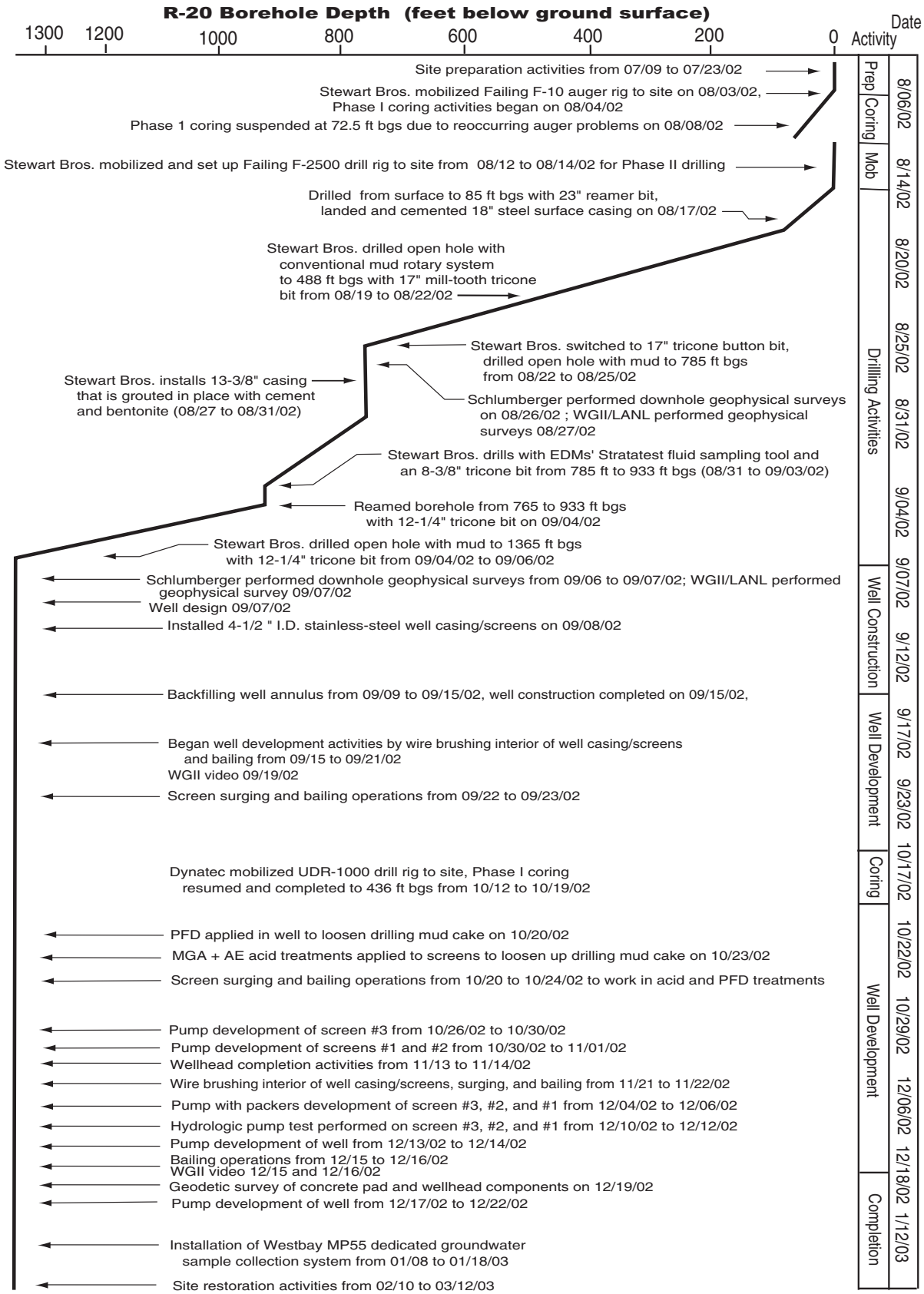


Figure 3.0-2. Operations chronology diagram, characterization well R-20

On August 7, 2002, Stewart Brothers advanced 18-in. augers into the Tshirege Member of the Bandelier Tuff to avoid the difficulties associated with coring through the alluvium. The temporary 10.25 surface casing was pulled from the borehole. During an attempt to advance the augers to 85 ft bgs, the augers separated at 50 ft bgs, leaving 35 ft of auger in the borehole between 50 and 85 ft bgs. On August 8, 2002, after unsuccessful attempts to fish out the augers that remained in the second borehole, it was abandoned and plugged by pumping cement grout through a tremie pipe and filling the borehole to ground surface. At this time, the Laboratory suspended coring operations until after Phase II drilling and well installation.

Dynatec resumed coring activities on October 12, 2002, after Stewart Brothers completed Phase II drilling and well installation. Dynatec mobilized the UDR-1000 drill rig to the site and advanced a new third borehole from ground surface to 75 ft bgs with an 8.75-in. tricone drill bit. While surface casing was being installed to approximately 50 ft bgs, the casing string parted at about 30 ft bgs. The casing was retrieved and subsequent attempts to ream and clear the borehole were unsuccessful. On October 14, 2002, Dynatec plugged and abandoned the third borehole by pouring hydrated bentonite chips into the borehole from 50 ft bgs to the surface.

Dynatec demobilized the UDR-1000 drill rig and mobilized the DR-24 drill rig to the site on October 15, 2002. Then, at the new fourth borehole location, 9.625-in. drill casing was advanced with a 10.75-in. under reaming down-the-hole hammer (UR-DTH) bit from ground surface to 70.5 ft bgs where the casing was landed. A mixture of water and E-Z Mud® was used to facilitate cuttings removal from the borehole. Following cuttings removal, 5.5-in. surface casing was installed within the 9.625-in. drill casing to 69 ft bgs. The annular space between the two casings was backfilled with 0.375-in. bentonite chips as the 9.625-in. drill casing was removed.

On October 16, 2002, the DR-24 drill rig was removed from the site and the UDR-1000 rig was mobilized to the site. The borehole was advanced to 72.5 ft and coring resumed using a 5-ft-long, 2.5-in.-ID core barrel; coring concluded at 436 ft bgs on October 19, 2002. The cored hole was backfilled with Pelplug® bentonite pellets to 102 ft bgs, Hole-Plug® bentonite chips to 27 ft bgs, cement to 2 ft bgs and gravel to ground surface. Phase I operations concluded on October 19, 2002.

3.2 Phase II Drilling

On August 12, 2002, Stewart Brothers mobilized a Failing F-2500 drill rig and support equipment to the site. Following the unsuccessful attempts to core, a new borehole was started. The borehole for Phase II was drilled using conventional mud-rotary methods. Various additives were mixed with municipal water to improve borehole stability, minimize fluid loss, and facilitate cuttings removal from the borehole. The conventional mud fluid mixture at R-20 typically consisted of municipal water mixed with varying amounts of soda ash, QUICK-GEL®, LIQUI-TROL™, and QUICK-FOAM® (Appendix B). Lost circulation material (Magma-Fiber and N-seal) was used as needed in the mud mixture to maintain or regain circulation within the borehole (Table 3.2-1).

Stewart Brothers provided the equipment used to mix and circulate drilling fluids. This equipment included a mixing tank and pump assembly, a generator to power the mixing unit, and a shaker unit for removing solids from the discharged drilling fluids. From August 12 to August 15, 2002, Stewart Brothers positioned drilling-fluid mixing equipment and conducted rig maintenance.

Table 3.2-1
Fluid Additives Used, Characterization Well R-20

Additive	Amount	Unit of Measure
Interval Drilled (0–780 ft)		
Water	48,300	gal.
QUICK-GEL®	26,565	lb
LIQUI-TROL™	135	gal.
QUICK FOAM®	483	gal.
Soda ash	536	lb
Interval Drilled (780–1365 ft)		
Water	37,100	gal.
QUICK-GEL®	7,000	lb
LIQUI-TROL™	87	gal.
Pac-L	200	lb
N-Seal	100	lb
Magma Fiber	620	lb

From August 15 through 17, 2002, Stewart Brothers installed an 18-in. steel conductor casing by advancing a borehole through the alluvium with a 23-in. tricone bit from ground surface to 85 ft bgs. The conductor casing was landed 12 ft into the Tshirege Member of the Bandelier Tuff and cemented in place on August 17, 2002. On August 22, 2002, open-hole drilling was conducted with a 17-in. mill-tooth tricone bit from 85 to 488 ft bgs through intervals of the Tshirege Member of the Bandelier Tuff, the Cerro Toledo, the Otowi Member of the Bandelier Tuff (including the Guaje Pumice Bed), and into the Cerros del Rio basalt. Stewart Brothers then switched to a 17-in. tricone button bit to increase the drilling rate in the basalt. Drilling continued from 488 ft bgs, with sporadic loss of fluid circulation, down to 500 ft bgs. On August 24 and 25, 2002, drilling advanced from 500 to 785 ft bgs with no circulation of cuttings return to the surface. No cuttings were recovered from 490 to 785 ft bgs.

On August 27, 2002, a 13.375-in. conductor casing was installed to a depth of 780 ft bgs; the annulus between 552 and 780 ft bgs was grouted with cement to seal off lower portions of the borehole that contributed to the loss of drilling fluid. The upper portion of the annulus was backfilled with a combination of Quick-Grout® bentonite grout, Pelplug® bentonite pellets, and Hole-Plug® bentonite chips to 79 ft bgs. The annular interval above 79 ft bgs was backfilled with cement on August 31, 2002.

At the Laboratory's request, EDM Systems (USA), a German firm, conducted a demonstration of Stratatest™, from August 31 to September 3, 2002. This formation fluid-sampling and -testing tool is designed to operate just behind a drill bit as part of the drill stem. The tool is intended to aid in collecting representative groundwater samples from discrete water-production zones by placing a sand pack above and below a 5-ft-long target interval. With the sand packs in place, water is pumped to develop the isolated zone. A groundwater sample is collected after the zone has been adequately developed. During drilling with the Stratatest™ tool, the borehole was advanced from 785 to 933 ft bgs using an 8.375-in. tricone bit. No groundwater samples were collected with the Stratatest™ tool.

On September 4, 2002, Stewart Brothers continued mud-rotary drilling operations with a 12.25-in. tricone bit. The borehole was reamed through slough from 785 to 933 ft bgs and then advanced to 1365 ft bgs,

where TD was called in Santa Fe Group sediments on September 6, 2002. Drilling activities for Phase II were completed on September 7, 2002.

4.0 SAMPLING AND ANALYSIS OF CORE, DRILL CUTTINGS, AND GROUNDWATER

Core samples were collected and analyzed for anions using ion chromatography (IC) and for radionuclides using counting techniques for characterization purposes. Thirteen core samples were collected from the vadose zone during drilling from 9.5 to 434.0 ft bgs. Approximately 500 to 1000 g of core or cuttings samples were placed in appropriate sample jars in protective plastic bags before they were analyzed by EES-6 and General Engineering Laboratories (GEL). The results will be reported in an investigation report for the TA-54 wells.

Table 4.0-1
Anion Concentrations in Alluvial Groundwater, Characterization Well R-20

Anion	Concentration (mg/L)
Cl	33.0
NO_3 (as NO_3)	16.1
SO_4	9.89

Drill cuttings were collected at 5-ft intervals as specified in the R-16, R-20, R-23, R-32 SAP. A portion of the cuttings was sieved (at >#10 and >#35 mesh) and placed in chip tray bins along with an unsieved portion. These samples were used to prepare a lithologic log (Appendix C). The remaining cuttings were placed in ziplock bags and set in core boxes for curation. Before curation, 12 sample splits were removed for use in mineralogy, petrography, and geochemical analyses.

Alluvial groundwater was encountered at 17.2 ft bgs. A sample was collected and analyzed for anions; results are provided in Table 4.0-1. No perched intermediate groundwater was encountered at well R-20 during fluid-assisted drilling. Regional groundwater was encountered at 837 ft bgs on September 4, 2002.

Geochemistry of Sampled Waters

Two regional aquifer water samples were collected from the developed well and were analyzed for a limited suite of constituents. These samples were collected from screen 2 (1147.1 to 1154.7 ft) and from screen 3 (1328.8 to 1336.5 ft). Screen 1 (904.6 to 912.2 ft) did not produce a sufficient volume of water to permit sampling. The samples were collected at depths of 1151 and 1336 ft primarily to determine if potential contaminants were present in the regional aquifer. Major potential contaminants of concern at R-20 include mobile solutes such as nitrate, perchlorate, uranium, and tritium.

Groundwater samples analyzed for inorganic and organic chemicals, tritium, and other radionuclides were collected by using a submersible pump and packers. Temperature, turbidity, pH, alkalinity, and specific conductance were determined on the site. Both filtered (metal, trace-element, and major cation and anion) and nonfiltered (radionuclide, organic-compound, and stable-isotope) samples were collected for chemical and radiochemical analysis. Aliquots of the samples were filtered through a 0.45-µm Gelman filter. Samples were acidified with analytical-grade nitric acid to a pH of 2.0 or less for metal and major ion analyses. All groundwater samples collected in the field were stored at 4°C until they were analyzed. Alkalinity was determined in the field using standard titration techniques.

Groundwater samples were analyzed by EES-6 using techniques specified in the US Environmental Protection Agency (EPA) SW-846 manual (available at http://clu-in.org/char1.cfm).

IC was the analytical method used for bromide, chloride, fluoride, nitrate, nitrite, oxalate, perchlorate, phosphate, and sulfate. Mercury was analyzed by cold vapor atomic absorption (CVAA). Inductively coupled (argon) plasma emission spectroscopy (ICPES) was the analytical method used for calcium, magnesium, potassium, silica, and sodium. Aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, uranium, and zinc were analyzed by inductively coupled (argon) plasma mass spectrometry (ICPMS).

Radionuclide activity in groundwater was determined by electrolytic enrichment for tritium; alpha spectrometry was the analytical method used for americium, plutonium, and uranium isotopes; gas proportional counting was used for strontium-90; liquid scintillation was used for technetium-99; and gamma spectrometry was used for cesium-137 and other gamma-emitting isotopes. Contract laboratories that conducted this work were GEL (radionuclides) and the University of Miami (low-level tritium). Stable isotopes of oxygen (oxygen-18 and oxygen-16, $\delta^{18}O$) and hydrogen (hydrogen and deuterium, δD) were analyzed by Geochron Laboratories (Cambridge, Massachusetts) using isotope ratio mass spectrometry (IRMS).

The precision limits (analytical error) for major ions and trace elements generally were less than ±10% using ICPES and ICPMS. Core samples were collected; analytical results (for inorganics and radionuclides) will be provided in an investigative report.

Tables 4.1-1 and 4.1-2 provide screening analysis results for the two groundwater samples collected from the Cerros del Rio lavas and pumiceous fanglomerates. Although strontium-90 was detected near the minimum detection activity level, the absence of tritium suggests that the waters have not been impacted by Laboratory releases.

Table 4.1-1
Hydrochemistry of Regional Aquifer Filtered Samples, Characterization Well R-20

Parameter and Analyte	Cerros del Rio Lavas Screen 2 (1151 ft bgs)	Pumiceous Fanglomerates Screen 3 (1336 ft bgs)
Field Parameter		
pH	7.04	6.84
Temperature (ºC)	21.8	22.5
Specific conductance (μS/cm)	128	100
Turbidity (NTU)	2.84	43.7
Analyte		
Alkalinity (mg $CaCO_3$/L)	54	36
Al (mg/L)	0.011	0.013
Sb (mg/L)	[0.001], U	[0.001], U
As (mg/L)	0.0017	0.0021
B (mg/L)	0.008	0.010
Ba (mg/L)	0.031	0.033
Be (mg/L)	[0.001], U	[0.001], U
HCO_3 (mg/L)	66	44

Table 4.1-1 (continued)

Parameter and Analyte	Cerros del Rio Lavas Screen 2 (1151 ft bgs)	Pumiceous Fanglomerates Screen 3 (1336 ft bgs)
Br (mg/L)	0.03	0.03
Cd (mg/L)	[0.001], U	[0.001], U
Ca (mg/L)	9.34	7.43
Cl (mg/L)	2.13	2.42
ClO_4 (mg/L)	[0.002], U	[0.002], U
Cr (mg/L)	0.0039	0.0013
Co (mg/L)	[0.001], U	0.0029
Cu (mg/L)	0.0036	0.0026
F (mg/L)	0.28	0.55
Fe (mg/L)	0.09	0.22
Pb (mg/L)	0.0004	0.0003
Mg (mg/L)	2.21	1.72
Mn (mg/L)	0.042	0.110
Hg (mg/L)	0.00008	0.00006
Mo (mg/L)	0.0016	0.0026
Ni (mg/L)	0.0043	0.0037
NO_3 (mg/L) (as N)	0.01	[0.005], U
NO_2 (mg/L) (as N)	[0.005], U	[0.005], U
C_2O_4 (mg/L) (oxalate)	[0.02], U	[0.02], U
PO_4 (mg/L) (as P)	0.60	2.21
K (mg/L)	2.35	2.05
Se (mg/L)	[0.001], U	[0.001], U
Ag (mg/L)	[0.001], U	[0.001], U
Na (mg/L)	12.3	13.8
SiO_2 (mg/L)	81.1	89.2
Sr (mg/L)	0.092	0.062
SO_4 (mg/L)	2.78	4.89
Tl (mg/L)	[0.001], U	[0.001], U
U (mg/L)	0.0007	0.0003
V (mg/L)	0.005	0.004
Zn (mg/L)	0.49	0.79
TDS (mg/L) (calculated)	180	170

Notes: 1. All samples collected December 5, 2002.
2. U = not detected.
3. Silica concentrations were calculated from measured silicon (ICPES).
4. Bicarbonate concentrations were calculated from measured alkalinity.

Table 4.1-2
Hydrochemistry of Nonfiltered Regional Aquifer Samples, Characterization Well R-20

Parameter and Analyte	Cerros del Rio Lavas Screen 2 (1151 ft bgs)	Pumiceous Fanglomerates Screen 3 (1336 ft bgs)
Tritium (pCi/L)	[0.32], U	[0.19], U
Am-241 (pCi/L)	[-21.9], U	[3.71], U
Cs-137 (pCi/L)	[-1.67], U	[-0.044], U
Gross alpha (pCi/L)	[0.98], U	[2], U
Gross beta (pCi/L)	1.51	1.59
Gross Gamma (pCi/L)	[115], U	[102], U
Pu-238 (pCi/L)	[0.002], U	[0.005], U
Pu-239,240 (pCi/L)	[-0.005], U	[-0.005], U
Sr-90 (pCi/L)	0.280±0.083, MDA, 0.2	0.351±0.100, MDA, 0.11
Tc-99 (pCi/L)	[-0.69], U	[2.37], U
U-234 (pCi/L)	0.369	0.317
U-235 (pCi/L)	[0.0248], U	[0.0271], U
U-238 (pCi/L)	0.198	0.157
TOC (mgC/L)	2.13	2.77
Acetone (μg/L)	60.5	17.5
Toluene (μg/L)	11.3	4.8
δD (‰)	-79	-81
$\delta^{18}O$ (‰)	-11.4	-11.3

Notes: 1. All samples collected December 5, 2002.
2. U = not detected.
3. ‰ = permil.
4. MDA = minimum detectable activity.
5. NTU = nephelometric turbidity unit.
6. TOC = total organic carbon.
7. Standard deviation is 1 sigma.

5.0 BOREHOLE GEOPHYSICS

WGII (using Laboratory tools) and Schlumberger provided geophysical logging services at R-20. Table 5.0-1 lists borehole and well logging surveys performed at R-20.

Table 5.0-1
Borehole and Well Logging Surveys Conducted, Characterization Well R-20

Operator	Date	Method	Cased Footage	Open-Hole Interval (ft bgs)	Remarks
Schlumberger	August 26, 2002	Logging suite[a,b]	0–80	80–785	Conducted in borehole prior to installation of 13.375-in. thin-walled conductor casing.
WGII/LANL	August 27, 2002	Video, natural gamma, induction	0–80	80–785	Conducted in borehole prior to installation of 13.375-in. thin-walled conductor casing.
Schlumberger	September 6–7, 2002	Logging suite[b,c]	0–780	780–1365	Conducted in borehole prior to design and installation of the well casing.
WGII/LANL	September 7, 2002	Natural gamma	0–780	780–1365	Conducted in borehole prior to design and installation of the well casing.
WGII/LANL	November 19–20, 2002	Video, natural gamma	0–1353.3	NA[d]	Video log run to document and verify well screen intervals and interior condition of the well. Natural gamma tool was run to verify backfill placement.
WGII/LANL	December 15, 2002	Video	0–1353.3	NA	Video log run to document and verify interior condition of the well during development.
WGII/LANL	December 16, 2002	Video	0–1353.3	NA	Video log run to 1351 ft bgs to document and verify interior condition of the well prior to Westbay™ installation.

[a] First suite of Schlumberger borehole logging surveys on August 26, 2002, included array induction, combinable magnetic resonance, triple detector lithodensity (TLD), sonic borehole caliper, elemental capture sonde, thermal\epithermal compensated neutron log, and natural gamma.

[b] Array induction imager, combinable magnetic resonance, formation microimager, and borehole caliper were run only in the open portion of the borehole.

[c] Second suite of Schlumberger borehole logging surveys included array induction imager, formation microimager, TLD, thermal\epithermal compensated neutron log, and natural gamma.

[d] NA = Not applicable; video and natural gamma logs were performed inside the well casing.

5.1 LANL-Supported Geophysical Logging

On five days between August 27 and December 16, 2002, WGII ran natural gamma, induction, and/or video logs in borehole R-20 using down-hole logging tools provided by the Laboratory. Three natural gamma logs were run. The first two were run to provide lithologic and stratigraphic information that complemented data gathered from cuttings. The third was run to verify and document the placement of annular backfill materials. An induction log also was run with the first natural gamma log. Four video logs were run to record lithologic and hydrogeologic features and to observe and document the condition of the interior of the well during and after development.

Natural gamma logs have proven successful in discriminating between geologic units with varying concentrations of uranium, thorium, and potassium. The induction tool has been useful in differentiating

between formations with different conductivity and resistivity. The first gamma log was run inside the 18-in. surface casing from the surface to 80 ft bgs and in the open borehole from 80 to 785 ft bgs prior to installation of the 13.375 in. thin-walled steel conductor casing. The induction log also was run at this time. The second gamma log was run with the 18-in. surface casing in place from surface to 80 ft bgs and the 13.375-in. conductor casing from ground surface to 780 ft bgs, and in the open borehole from 780 to 1365 ft bgs. The third natural gamma log was run inside the well to a depth of 1353 ft bgs. Measurements of natural gamma activity were obtained every 0.1 ft as the logging tool was raised upward in the hole at a rate of about 15 ft/min.

The first video log was run before the first natural gamma log (Table 5.0-1) to evaluate borehole stability before the natural gamma and induction logging tools were deployed. This first video log was run to record stratigraphic, geologic, and hydrologic features present in the open portion of the borehole. Appendix D (on a CD on the inside back cover of this report) contains the video log of the open borehole. Three additional video logs were run as a quality-control procedure to verify and document well construction and to inspect the condition of casing and screens during and after well development but before installation of the Westbay™ system.

5.2 Schlumberger Geophysical Logging

Schlumberger personnel conducted borehole geophysical logging in the R-20 borehole on August 26, 2002, and again on September 6 through 7, 2002, in the R-20 borehole. The logging tools run for each suite are presented as notes to Table 5.0-1. The first suite of logging surveys was run inside the 18-in. surface casing from surface to 80 ft bgs and in open borehole from 80 to 785 ft bgs. The second suite of logging surveys was run before well design and construction, with the 18-in. surface casing in place from the surface to 80 ft bgs, the 13.375 in. conductor casing from ground surface to 780 ft bgs, and in open borehole from 780 to 1365 ft bgs.

The primary purpose of the Schlumberger logging was to characterize conditions in the hydrogeologic units that were penetrated by the R-20 borehole, with primary emphasis on determining the moisture distribution in the vadose zone and in the regional aquifer, measuring flow capacity, and gathering lithologic/stratigraphic data. Secondary objectives included evaluating borehole geometry and assessing the degree of drilling-fluid invasion along the borehole wall.

The Schlumberger suite of geophysical logging tools included the following:

- Array Induction Tool, Version H (AITH™) measures formation electrical resistivity and borehole fluid resistivity to evaluate drilling fluid invasion into the formation and determines the presence of moist zones far from the borehole wall.
- Combinable Magnetic Resonance (CMR™) measures the nuclear magnetic resonance response of the formation, evaluates total and effective water-filled porosity of the formations near the borehole wall, and estimates pore-size distribution and hydraulic conductivity.
- Triple detector LithoDensity (TLD™) measures formation bulk density related to formation porosity, photoelectric effects related to lithology, and borehole diameter using a single-arm caliper.
- Thermal/Epithermal Compensated Neutron Tool, Model G (CNTG™), measures volumetric water content beyond the casing to evaluate formation moisture content and porosity.
- Elemental Capture Sonde (ECS™) measures elemental weight concentrations of a variety of elements to characterize formation mineralogy, lithology, and water content.

- Fullbore Formation Micro Imager (FMI™) measures electrical conductivity images of the borehole wall and the borehole diameter with a two-axis caliper, thus evaluating geologic bedding and fracturing, including strike-and-dip of these features, fracture apertures, and rock textures.
- Digital Sonic Logging Tool (DSLT) measures acoustic compressional (P-wave) velocity to correlate seismic velocity with depth for calibrating surface seismic surveys.

Additionally, a calibrated natural gamma tool was used to record gross natural gamma activity with every logging method to correlate depth runs between each survey conducted.

The Schlumberger logging summary report for borehole R-20 and the geophysical logs for all Schlumberger methods, compiled as a montage, are contained in Appendix E (see CD attached to the inside back cover of this report).

6.0 LITHOLOGY AND HYDROGEOLOGY

A preliminary assessment of the hydrogeologic features encountered in borehole R-20 is presented below, including a description of the geologic units identified during cuttings-characterization. Groundwater occurrence is discussed and evaluated by drilling evidence and geophysical data.

6.1 Stratigraphy and Lithologic Logging

Rock units and stratigraphic relationships, interpreted primarily from examination of drill-cuttings samples and interpretation of geophysical data, are discussed in order of younger to older units encountered. Such interpretations may be refined upon further analysis of petrographic, geochemical, mineralogical, and geophysical logging. A field-generated lithology log for R-20 can be found in Appendix C.

Alluvium and Soil (0 to 68 ft bgs)

Unconsolidated dacite and tuffaceous sands and gravels, derived from the Tschicoma Formation and the Bandelier Tuff, were noted in the interval from 0 to 68 ft bgs. Samples indicate that these sediments are predominantly dacite and minor rhyodacite clasts in a matrix of quartz and sanidine crystals. The sediments represent alluvial deposits in Pajarito Canyon.

Bandelier Tuff (68 to 392 ft bgs)

The Quaternary-age Bandelier Tuff occurs in the interval from 68 to 392 ft bgs (Appendix C). Units that are represented in cuttings samples include the Tshirege Member, the Cerro Toledo interval (an informal unit), and the Otowi Member, including the Guaje Pumice Bed.

Tshirege Member of the Bandelier Tuff, Undivided (68 to 166 ft bgs)

The Tshirege Member of the Bandelier Tuff is made up of a succession of rhyolite ash-flow tuffs (Broxton and Reneau 1995, 49726); rocks of this unit were encountered from 68 to 166 ft bgs in R-20. Subunits of the Tshirege Member were not identified on preliminary analysis of the R-20 data. Cutting samples in the upper one-third of the Tshirege Member are lithic-rich, with lithics composed predominantly of gray porphyritic dacite and minor rhyolite. The Tshirege Member is not typically lithic-rich at other locations, and the lithic-rich nature of the cuttings may be the result of ash and pumice separation from lithic-rich concentrates by circulating drilling fluids. Pumice predominates as the major constituent in the lower two-thirds of the section. Pumice fragments, typically 40% to 90% by volume, are unaltered or variably altered

to clay, producing an earthy texture. The lower part of the Tshirege Member also contains variable percentages of dacite lithics and quartz and sanidine crystals. The Tsankawi Pumice Bed, a 2- to 3-ft-thick fall deposit that typically occurs at the base of the Tshirege Member, could not be identified in the drill cuttings.

Cerro Toledo Interval (166 to 183 ft bgs)

The Cerro Toledo interval was encountered from 166 to 183 ft bgs. Cuttings indicate that the interval is composed of subrounded dacitic and rhyodacitic clasts (85% to 95% by volume), with minor percentages of pumice and detrital quartz and sanidine crystals.

Ash Flows of the Otowi Member of the Bandelier Tuff (183 to 374 ft bgs)

Ash-flow tuffs of the Otowi Member were intersected in the borehole from 183 to 374 ft bgs. Cuttings suggest that the Otowi Member is poorly welded to nonwelded and lithic- and pumice-rich. Coarse chip samples contain highly variable percentages of volcanic lithics, composed of dacite, silicified dacite, and rhyodacite, and white-to-orange vitric and clay-altered pumice. Finer-sieved sample fractions typically contain intermediate volcanic lithics, pumice fragments, and quartz and sanidine crystals in roughly equal proportions.

Guaje Pumice Bed of the of the Otowi Member of the Bandelier Tuff (374 to 392 ft bgs)

The Guaje Pumice Bed of the Otowi Member is a pumice-fall deposit that regionally forms the basal unit of the Bandelier Tuff. Borehole R-20 intersected the Guaje Pumice Bed from 374 to 392 ft bgs. Drill cuttings from this interval indicate that the unit is nonwelded and made up of vitric to slightly clay-altered pumice (60% to 80% by volume) with subordinate amounts of pinkish and gray dacite lithics and quartz and sanidine crystals.

Cerros del Rio Lavas (392 to 932 ft bgs)

The R-20 borehole encountered lavas and cinder deposits of the Cerros del Rio lavas in a 540-ft thick interval from 392 to 932 ft bgs (Appendix C). The upper part of the Cerros del Rio section, from 392 to 820 ft bgs, is composed of a series of basaltic flows separated by layers of scoriaceous breccia. Identification of this subunit is uncertain in part because fluid circulation was lost during drilling and no samples were recovered in the interval from 490 to 785 ft bgs. Cuttings from recovered samples suggest that at least three lava flows may be represented.

Two flow units occur in the interval from 392 to 490 ft bgs, both characterized as slightly porphyritic with sparse olivine phenocrysts in an aphanitic groundmass. A 5- to 10-ft thick layer of oxidized scoriaceous basalt is evident at the base of both flows. The upper of these two lavas exhibits partial alteration in the form of iron oxides and local clay development on fractures. Generally stronger rock alteration in the lower flow is evidenced by opaque iddingsite replacement of olivine and alteration of groundmass minerals that intensifies with depth. A third lava flow that lacks olivine phenocrysts and exhibits stronger alteration and bleaching is evident in the interval from 785 to 820 ft bgs.

Cuttings suggest that the basal Cerros del Rio section, from 820 to 932 ft bgs, is made up of basalt, basaltic scoria, and local volcaniclastic sediments. Chip samples contain massive aphyric basalt and black vitric scoria. Samples from the lowermost part of this interval contain downward-increasing percentages of subrounded detrital dacite, pumice, white clay, and minor quartzite and granitic lithics.

Puye Formation (932 to 1242 ft bgs)

The Pliocene Puye Formation, encountered from 932 to 1242 ft bgs (Appendix C), is represented by two volcaniclastic fanglomerate facies. The upper facies is composed predominantly of dacite-rich detritus, and the lower facies contains abundant pumice.

Dacite-rich Puye Formation sediments occur in the interval from 932 to 1127 ft bgs. Cuttings indicate clay-rich volcaniclastic sands and gravels containing porphyritic pink and gray dacites (commonly 80% to 95% by volume) as major constituents, with minor amounts of basalt, pumice, and quartzite. Preserved fragments of volcaniclastic sandstone indicate that these sediments are at least moderately indurated. The Puye Formation facies encountered from 1127 to 1242 ft bgs is interpreted as a pumiceous fanglomerate. Cuttings show that this interval contains significant percentages of white clay-altered pumice fragments (typically in the range of 20% to 50% by volume) in addition to clasts of dacite, minor basalt, and up to 3% quartzite. The pumiceous unit is included here with the Puye Formation, but this unit is poorly known and its stratigraphic assignment is uncertain.

Santa Fe Group (?) Sediments (1242 to 1365 ft bgs)

Volcaniclastic sand and gravel deposits, encountered from 1242 ft bgs to the bottom of the borehole at 1365 ft bgs (Appendix C), are tentatively assigned to the Santa Fe Group. Sediments in this interval are primarily composed of subrounded dacite and rhyodacite clasts that typically make up 80% to 95% by volume of the coarse-sized cuttings. Subordinate lithic constituents include scoriaceous basalt, white clay-altered pumice, and up to 5% quartzite. Quartzite particle surfaces are commonly smooth and frosted.

6.2 Groundwater Occurrence and Characteristics

When the SAP was written, it was expected that the regional water table at R-20 would be encountered at around 854 ft bgs in the Puye Formation. Perched water was also expected, but the SAP did not indicate specific depths. Alluvial waters were encountered at approximately 17 ft bgs. This zone produced enough water to fill 40 ft of the 10-in.-diameter borehole and surface casing was installed to seal off the zone before Phase I coring could continue.

The regional water table was encountered on August 27, 2002, in cinder deposits of the Cerros del Rio lavas. After circulating drilling fluids from the borehole, the first water-level measurement indicated a depth to water of 873 ft bgs. At this time the conductor casing was set at 780 ft bgs, and the borehole was open to 913 ft bgs. A composite groundwater level was measured again at 857.7 ft bgs on September 17, 2002, after well construction but before well development. Near the end of well development activities, on December 20, 2002, the composite groundwater level was measured at 832.3 ft bgs, after a 14-hr stabilization period.

7.0 WELL DESIGN AND CONSTRUCTION

Sections 7.1 and 7.2 describe R-20 well design and construction, respectively.

7.1 Well Design

The design for well R-20 was completed jointly by the Laboratory and WGII, in consultation with the New Mexico Environment Department (NMED) and the US Department of Energy (DOE). Information gathered from geophysical logs, video logs, borehole geologic samples, water-level data, field water-quality data,

and drillers' observations was analyzed by the Groundwater Integration Team to plan screen placement intervals for the well.

The final well design specified three screens in the regional aquifer and installation of a Westbay™ sampling system. No intermediate perched zones were identified; therefore, no screens were placed above the regional water table. The planned and actual screen intervals are given in Table 7.1-1. The proposed well design supports the data quality objectives (DQOs) for the regional aquifer, including installing a monitoring well between potential release sites at TA-54 and supply well PM-2 and gathering information about the extent of the capture zone at PM-2.

Table 7.1-1
Well Screen Information, Characterization Well R-20

Screen	Planned Depth (ft)	Actual Depth (ft)	Geologic/Hydrologic Setting
1	904.6–912.3	904.6–912.2	Near top of regional aquifer in cinder beds of the Cerros del Rio lavas
2	1147.2–1154.3	1147.1–1154.7	Within regional aquifer in the pumiceous Puye fanglomerate
3	1320.2–1336.9	1328.8–1336.5	Within regional aquifer in the Santa Fe Group sediments

Screen 1 was located near the top of the regional zone of saturation and is the shallow measurement point for vertical hydraulic gradients. This location was fixed relative to the water level of 873 ft bgs measured on August 27, 2002, with the top of the sand pack placed 20 ft below measured water level so the screen would be completely submerged for proper well development. Screen 1 also can be used to monitor groundwater quality near the top of the regional zone of saturation.

Screen 2 was located approximately halfway between screens 1 and 3 for vertical gradient information. Schlumberger geophysical logs were used to select a typical porosity/permeability zone for screen placement. Screen 2 also provides an opportunity to determine if water chemistry in this area is vertically stratified.

Screen 3 was located as deep as possible in the completed borehole for vertical gradient information. Schlumberger geophysical logs were used to select a relatively high-porosity/high-permeability zone for the screen so that the upper end of the permeability distributions could be targeted for straddle-packer/ injection tests in the completed well. These deposits may represent a fast pathway in the regional system, and this screen provides an opportunity to characterize the groundwater at this depth.

7.2 Well Construction

The casing and pipe-based screens for R-20 were manufactured using 4.5-in.-ID/5-in.-OD, type 304 stainless steel fabricated to American Society for Testing and Materials (ASTM) standard A554. External couplings were also type 304 stainless steel fabricated to ASTM standards A312 and A511, both of which exceed the tensile strength of the threaded casing ends. The pipe-based screens were modified by Weatherford Well Screens (Johnson Screens, Inc.) from 10-ft sections of blank well casing. Weatherford drilled a series of 0.5-in.-diameter holes with 168 holes/ft and then welding a stainless steel wire-wrap (with 0.010-in. spacing) over the perforated interval. The final OD of the screens was 5.56 in.

All stainless steel well components were cleaned at the well site using a steam cleaner and scrub brushes. All annular materials were placed in the borehole/well casing annulus through a tremie pipe. Well construction activities were completed from September 8 to 15, 2002 (Figure 3.0-2).

7.2.1 Well Installation

Stewart Brothers installed the R-20 well casing and screen from September 8 to September 9, 2002. Well installation consisted of joints of stainless steel well casing and screen sections by means of threaded couplings. The bottom of the well was set at 1353.3 ft bgs. Stainless steel centralizers were installed above and below each screen and in several locations above the zone of regional saturation to centralize the well during annular fill placement operations. Figure 7.2-1 shows the as-built well casing configuration and indicates the depths of the various well components from ground surface.

7.2.2 Annular Fill Placement

From September 9 through 15, 2002, Stewart Brothers completed annular fill placement. A steel tremie pipe was used to deliver the annular materials to the specified depths (Figure 7.2-1). The bottom of the borehole was measured at 1362.5 ft bgs prior to material placement. Filter packs across screened intervals consisted of silica sand materials mixed with municipal water and placed in the annulus. Bentonite was placed between screened intervals to seal off the annular space and isolate the water-bearing zones. Bentonite was placed using EZ-Mud® polymer mixed with municipal water. Portland® cement (mixed at a ratio of 5 gal. of water to each bag of cement) was used to provide foundations for the annular fill above the regional aquifer and for wellhead protection in the annular space around the upper 75 ft of the borehole. Approximately 41,400 gal. of municipal water were used during placement of annular fill material.

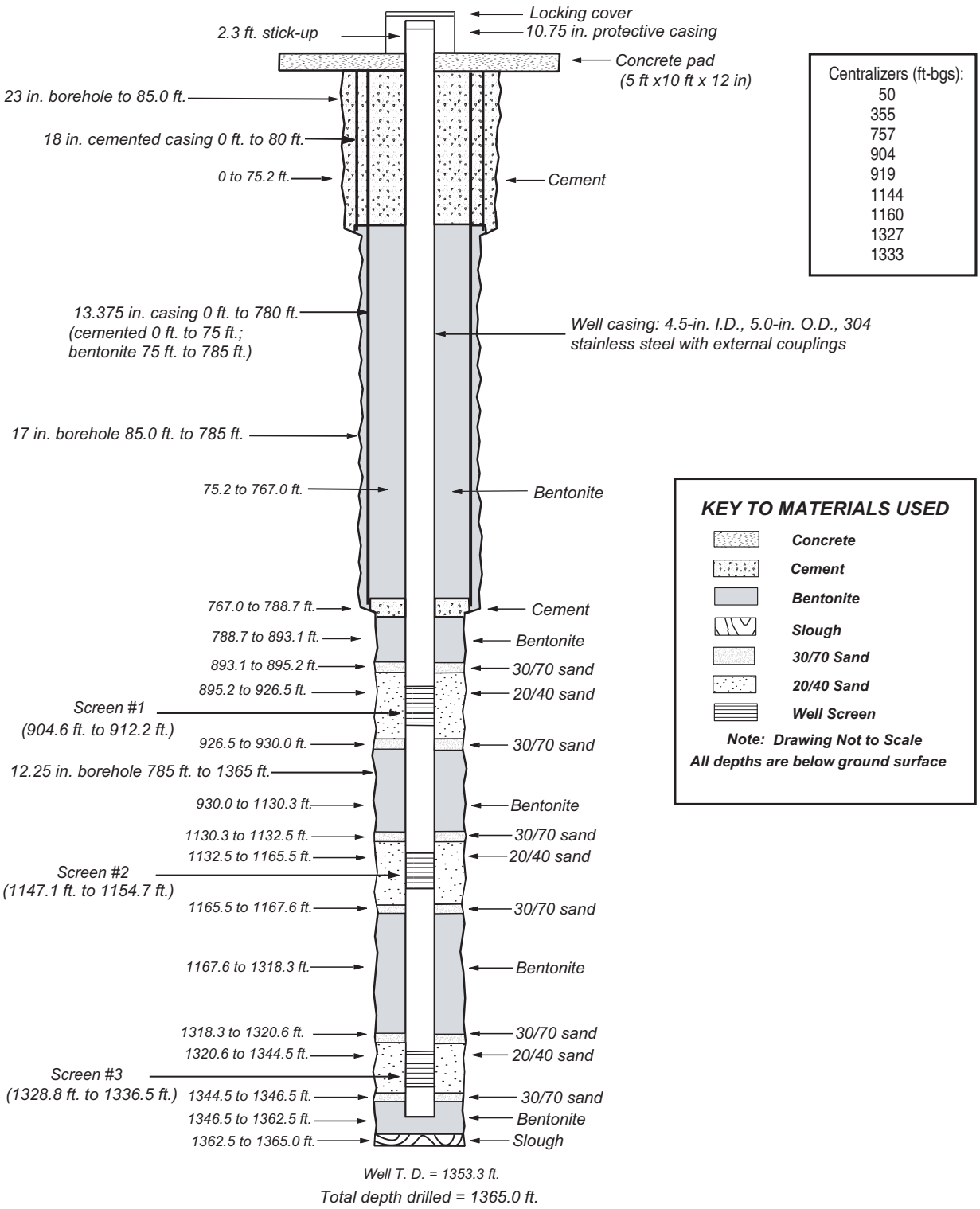
Table 7.2-1 summarizes the annular fill materials installed. The final configuration of annular materials is illustrated in Figure 7.2-1.

8.0 WELL DEVELOPMENT AND HYDROLOGIC TESTING

Well development and hydrologic testing activities at R-20 were conducted from September 15 to December 22, 2002 (Figure 3.0-2). Well-development procedures included wire-brushing, surging/bailing and chemically treating the well screens, and pumping. Development activities were followed by hydrologic tests conducted at all three well screens.

8.1 Well Development

Well development at R-20 was performed using a variety of methods. The initial stage consisted of wire-brushing the well interior, swabbing and surging the screened intervals to draw fine sediment from the constructed filter packs, and bailing to remove solid materials from the well. Chemical treatment procedures were applied to individual well screens to break up particulate matter and disperse borehole-wall filter cake that resulted from adding fluids during conventional mud-rotary drilling. The well then was pumped to remove remaining fines from the filter pack and adjacent formation.



Note: 1. Each screen interval lists the footage of the pipe perforations, not the top and bottom of screen joints.
2. The interval of slough consists of sands and gravel provisionally attributed to the Santa Fe Group.
3. Westbay multiport sampling system (MP-55) casing not shown.
4. Pipe-based screen: 4.5-in. I.D., 5.563-in. O.D., 304 stainless steel with s.s. wire wrap; 0.010-in slot.
5. Well sump interval: 1336.5 to 1353.3 ft.

Figure 7.2-1. As-built configuration diagram, characterization well R-20

Table 7.2-1
Annular Fill Materials, Characterization Well R-20

Material	Use/Function	Amount	Unit*
20/40 sand (medium-grained)	To pack screen intervals	115	bag
30/70 sand (fine-grained)	To separate filter packs from bentonite seals	27	bag
Benseal® (bentonite)	Granular (8-mesh) bentonite used for seals	5.5	bag
QUICK-GROUT®	High-solids bentonite grout used for seals	125	bag
Pelplug® bentonite (0.25-in. by 0.375-in., refined elliptical pellets)	To provide borehole annular seal below the water table	354	bucket
Portland® cement (mixed with municipal water at a ratio of 5 gal. water to 1 bag)	To provide annular support and surface seal on the upper portion of the borehole	48	bag

*Sand bag = 45 lb ea, bentonite bag/bucket = 50 lb ea, cement bag = 94 lb ea.

Criteria for well development were based on selected field water-quality parameters (turbidity, specific conductance, pH, and temperature). To monitor progress during development, samples of groundwater were withdrawn periodically and parameter measurements were made and recorded. One objective of well development was to remove suspended sediment from the water until turbidity stabilized to a value less than 5 nephelometric turbidity units (NTUs) for three consecutive samples. Similarly, other measured parameters needed to stabilize before the well could be declared successfully developed. The well was declared sufficiently developed when the above criteria were met or the measurements could not be improved. Table 8.1-1 presents pumping and water-quality parameter data recorded at the beginning and end of each well-development procedure.

Preliminary bailing using a 9-gal. steel bailer was performed from the R-20 well sump and screens 1, 2, and 3 between September 15 and 23, 2002. At that time, water produced from the well amounted to 6065 gal. To remove any materials that may have been introduced to the well interior during construction, the casing and screens were cleaned with a wire-brush system. Surging techniques were employed across all three screens using a surge block with an attached weight for rapid upward-downward strokes. The well screens were repeatedly surged, followed by periods of bailing. Surging/bailing activities were suspended on September 23, 2002.

On October 20, 2002, a dispersant solution containing 2.5 gal. of AQUA-CLEAR™-PFD (phosphate-free dispersant) in 950 gal. of municipal water was prepared and pumped into the well. Surging/bailing then was conducted across screens 1, 2, and 3. On October 23, 2002, an acidic solution containing 270 lb of AQUA-CLEAR™-MGA (modified granular acid) and 27 gal. of AQUA-CLEAR™-AE (acid enhancer) was mixed with 900 gal. of municipal water. Next, each of the three screened intervals was injected with approximately 300. gal of the mixture. Surging and bailing then resumed at each screen.

Development pumping began on October 25, 2002, and proceeded through November 1, 2002. Pumping initially was conducted at all screens without using inflatable packers. A 10-horsepower (hp) submersible pump then was lowered to the bottom of screen 3 and subsequently raised between screens 1 and 2. On/off cyclic pumping was conducted with approximately 30-min periods of nonpumping to allow water levels in the well to recover. Field parameters were measured hourly from collected water samples. A total of 61,760 gal. were pumped from the well during this phase of development.

Table 8.1-1
Development of Characterization Well R-20

Method	Water Produced (gal.)	Range of Parameters[a]			
		pH	Temperature (°C)	Specific Conductance (µS/cm)[b]	Turbidity (NTU)
Preliminary bailing/wire-brushing/surging	6,065	8.1–8.0	22.6–22.1	1481–259	>1000–226
Chemical treatment (add 950 gal. AQ-PFD)	+950	—	—	—	—
Surge/bail	850	9.1–9	19.5–23.3	1410–753	923–>1000
Chemical treatment (add 900 gal. AQ-AE and AQ-MGA)	+900	—	—	—	—
Surge/bail	400	3–6	22.1	309	91.8
Pump	61,760	3.8–7.1	20.8–22.3	2318–104	23.1–6
Wire brush/bail	650	6.8–7	19.1–21	294–130	>1000–>1000
Pump	1990	7–7	21–19.8	167–133	129–38.9
Pumping screen 3 w/packers	3850	6.7–6.6	23.2–24.1	121–106	57.4–4.7
Pumping at screen 2 w/packers	5255	7–7	22.1–21.8	107–128	112–2.8
Pumping at screen 3 w/packers	7925	6.8–6.7	22.6–20	114–108	185.6–4.2
Pumping at screen 1 w/packers	113	7.3	23.4	132	227
TOTAL	87,008				

[a] Parameters presented as value at beginning followed by value at end of development method.
[b] Specific conductance reported in microsiemens per centimeter (µS/cm).

On November 19, 2002, WGII conducted a video survey of the well. The survey found that sections of the well casing and screens 2 and 3 required additional wire-brush procedures. From November 21 to November 22, 2002, mechanical cleaning was followed by bailing and surging operations. Approximately 650 gal. of water were purged during these operations.

Development pumping using inflatable packers then was performed at each of the three screens. Packers were positioned above and below each screen to isolate the water-bearing zone, and pumping procedures, as described above, were applied to all three screens between December 4 and December 6, 2002. As indicated in Table 8.1-1, turbidity measurements from screens 3 and 2 were within acceptable ranges at the end of the pumping periods for both screens. Pumping procedures were also applied to screen 1. After withdrawing approximately 100 gal. from the well by pumping at this screen, the water level dropped below the pump intake. A total of 19,133 gal. were purged during this pumping phase. Groundwater samples were collected from screens 2 and 3 at the end of screen development.

A total of 87,008 gal. of water were withdrawn during all development activities conducted at R-20.

8.2 Hydrologic Testing

On December 10, 11, and 12, 2002, the Laboratory conducted straddle-packer/injection tests of saturated materials behind screens 1, 2, and 3 in well R-20. An injection assembly, consisting of two inflatable packers separated by a perforated pipe, was positioned around each screen. For a given screen, the

water-level response to injecting municipal water at different rates for different periods of time was monitored with a pressure transducer. Specifically, three tests were conducted at all three screens. A total of 1010 gal. of water was injected during these tests. Following the testing, approximately 8840 gal. of water were purged from the well. This amount represents more than five times the volume of water introduced during the tests. Results of these tests, as well as details of their design, implementation, and analysis, will be presented in a separate Laboratory report.

8.3 Installation of Westbay™ Monitoring System

A Westbay™ sampling system was installed inside the stainless steel well casing after development and testing procedures in well R-20 were completed. The base of the multiport casing was set at 1352.1 ft bgs. The system was set in place using a series of packers inflated with de-ionized water and positioned to target each well screen with a set of valve ports. The R-20 system contains eight ports used to monitor and test ten packers. Two measurement ports with a pumping port allow access to each screen. Quarterly sampling of Westbay™-equipped wells is accomplished using a Laboratory-owned sampling trailer equipped with the MOSDAX® sampling system (controller, sampler probe, and sample bottle train) and a motorized winch and boom system. The Westbay™ summary MP casing log provides details of the installed system (Appendix F, on a CD on the inside back cover of this report).

9.0 WELLHEAD COMPLETION AND SITE RESTORATION

After completion of the pump installation, finish work commenced on the wellhead area. Well components were surveyed, and the site underwent final cleanup and restoration.

9.1 Wellhead Completion

Surface completion for well R-20 involved installing a reinforced (3000 lb/square inch [psi]) concrete pad, 5-ft wide by 10-ft long by 6-in. thick, around the well casing to ensure long-term structural integrity of the well (Figure 9.1-1). The concrete pad was poured on November 13, 2002, and a brass survey cap was installed in the northwest corner of the concrete pad. The pad was designed to be slightly elevated, with base-course gravel graded around the pad to allow drainage. A 10-in. steel casing with locking lid protects the well riser. A 4-in.-diameter steel bollard was placed next to each of the four sides of the pad. One bollard can be removed to allow access to the well for sampling and maintenance.

9.2 Geodetic Survey

Southwest Mountain Surveys, Inc. (NMPLS #6998), conducted a geodetic survey of well R-20 on December 19, 2002, using a global positioning satellite (GPS) system. The GPS system utilized National Geodetic Vertical Datum of 99/96 for vertical computations and the datum for the horizontal control network is North American Datum 1983 (NAD 83). The survey located the brass monument in the northwest corner of the concrete pad and measured location and elevation at the top of the steel protective casing, the top of the Westbay™ cap, and the top of the Westbay™ plate (Table 9.2-1). The coordinates shown are in New Mexico State Plane coordinates, Central Zone (NAD 83) expressed in feet. To be consistent with current Laboratory standards, elevations are expressed in feet above mean sea level and referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

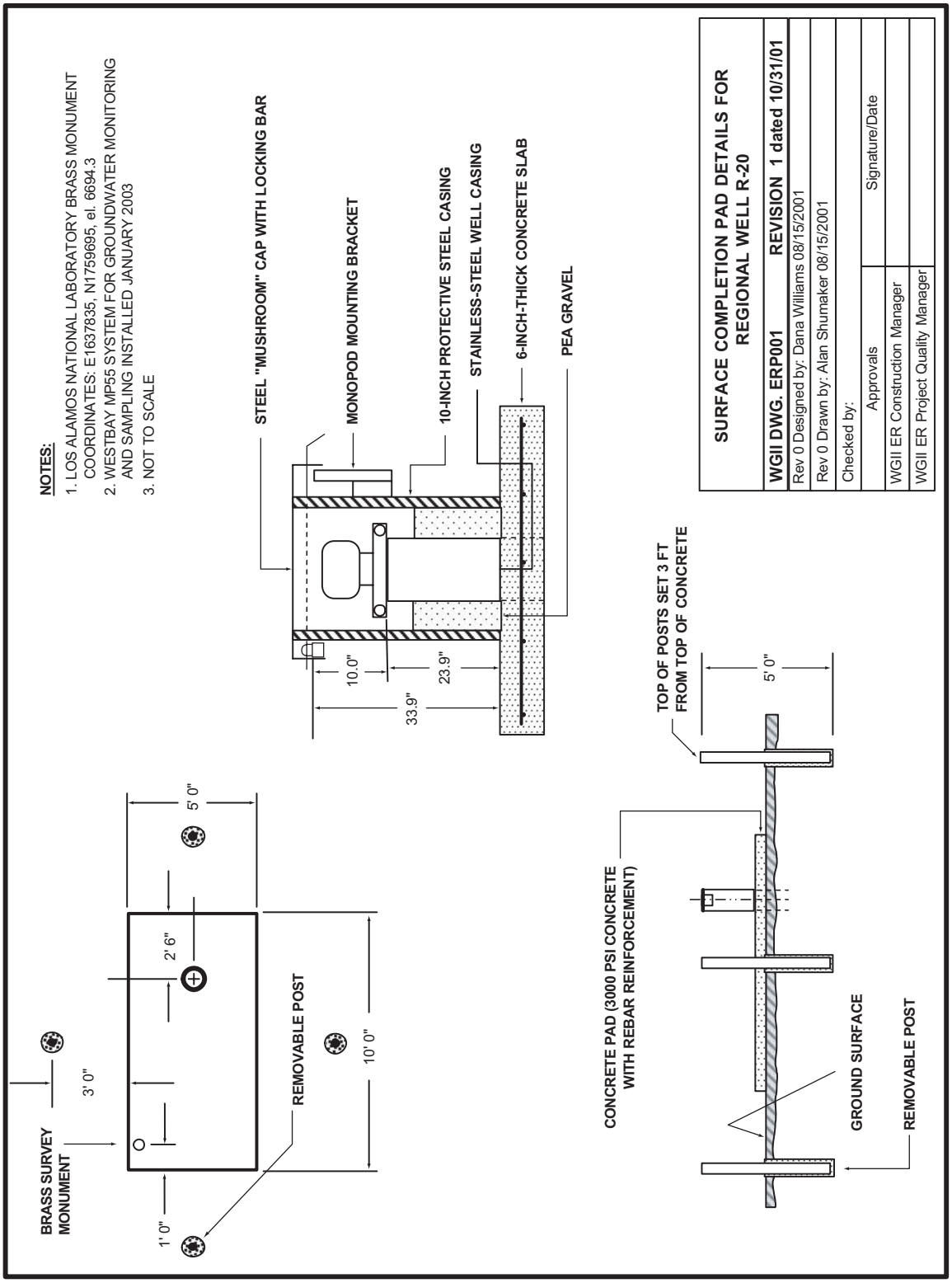


Figure 9.1-1. Surface completion configuration diagram, characterization well R-20

Table 9.2-1
Geodetic Data, Characterization Well R-20

Description	East	North	Elevation
Brass monument in R-20 pad	1637835.40	1759694.51	6694.35
Top of Westbay™landing plate	1637839.83	1759689.78	6696.68
Top of Westbay™ casing	1637839.92	1759689.73	6697.14
Top of steel protective well casing	1637839.66	1759689.89	6697.68

9.3 Site Restoration

Drilling site restoration activities at R-20 were conducted by K. R. Swerdfeger Construction, Inc., from February 24 to March 6, 2003 (Figure 3.0-2). Prior to and along with restoration, waste-management activities were also performed. Waste materials were removed from the site according to the WCSF. Drilling activity media included drilling fluids, cuttings, and development water. These were sampled for contaminant analysis (Appendix G). After the Laboratory and NMED reviewed the test data, the waste was approved for land application. The drill cuttings were used to help backfill the cuttings-containment area and the drilling fluids and development water were applied around the site with a 3-in.-pipe irrigation system as specified in the Notice of Intent. The waste streams from minor spill clean up included petroleum-contaminated soils and absorbent materials used during clean up. After the Laboratory approved the waste profile forms submitted by waste-management personnel the waste streams were disposed of as New Mexico Special Waste. Before the site was graded, the cuttings-containment area was excavated and the plastic lining was removed. The containment basin area then was backfilled with dirt that had been bermed during pad construction and regraded. Base-course gravel was also regraded and compacted across the site to form a smaller pad. The site was re-seeded with a blend of native grasses mixed with fertilizer to facilitate regrowth of ground cover.

10.0 DEVIATIONS FROM THE R-20 SAP

There were no significant deviations between the actual characterization activities versus planned activities described in the SAP.

11.0 ACKNOWLEDGEMENTS

Dynatec Drilling Company provided rotary drilling services.

Tetra-Tech EM, Inc.; D. B. Stephens and Associates, Inc.; and S. M. Stoller provided support for well-site geology, sample collection, and hydrologic testing.

Southwest Mountain Surveys, Inc. (NMPLS #6998), provided the final geodetic survey of finished well components.

D. Thompson and C. Schultz of PMC Technologies (Exton, Pennsylvania) and P. Schuh, E. Tow, and R. Lawrence of Tetra-Tech EM, Inc. (Albuquerque, New Mexico), contributed to the preparation of this report.

R. Bohn and E. Louderbough of Los Alamos National Laboratory reviewed this report for classification and legal purposes, respectively.

D. Broxton, P. Longmire, S. Pearson, W. Stone, and D. Vaniman of Los Alamos National Laboratory prepared this report.

Schlumberger Integrated Water Solutions provided processing and interpretation of borehole geophysical data.

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Appendix A

Activities Planned for R-20 Compared with Work Performed

Activity	"Hydrogeologic Workplan" (LANL 1998, 59599)	"Pajarito Canyon Workplan" (LANL 1998, 58820)	R-20 Sampling and Analysis Plan	R-20 Actual Work
Planned Depth	100 to 500 ft into the regional aquifer	Planned depth of 950 ft below ground surface (bgs)	Estimated depth of 1354 ft bgs	Total drill depth 1365 ft bgs
Drilling Method	Methods may include, but are not limited to, hollow-stem auger (HSA), air-rotary/Odex/Stratex, air-rotary/Barber rig, and mud-rotary drilling	Drilling methods not specified	Stiff foam air rotary, air-rotary, mud-rotary flooded-reverse circulation, and fluid-assist air-rotary with casing-advance	Conventional mud rotary, fluid-assisted air rotary with casing-advance, and air-rotary core with wireline retrieval
Amount of Core	10% of the borehole	May be continuously cored to 950 ft bgs	Continuous core from surface to estimated depth of 444 ft bgs (50 ft into Cerros del Rio), but no deeper than 450 ft bgs	Continuous core from surface to 436 ft bgs (44 ft into Cerros del Rio lavas)
Lithologic Log	Log to be prepared from core, cuttings, and drilling performance data	Log preparation not specified	Log to be prepared from core, cuttings, geophysical logs and drilling performance data	Log prepared from core, cuttings, geophysical logs, and drilling performance data
Number of Water Samples Collected for Contaminant Analysis	A water sample may be collected from each saturated zone, five zones assumed. The number of sampling events after well completion is not specified.	A water sample may be collected from each saturated zone, four zones assumed (3 intermediate perched zones and the regional aquifer). After the well is completed, groundwater from two depths will be sampled and analyzed, continuing on a semi-annual basis for two years.	If perched water is encountered, within the unsaturated zone, one groundwater-screening sample will be collected within up to three perched zones. Groundwater-screening samples will be collected within the regional aquifer at the regional water table and at the TD of the borehole.	One alluvial water sample collected at 17.5 ft. Two groundwater samples collected from screens 2 and 3.

Activity	"Hydrogeologic Workplan" (LANL 1998, 59599)	"Pajarito Canyon Workplan" (LANL 1998, 58820)	R-20 Sampling and Analysis Plan	R-20 Actual Work
Water Sample Analysis	Initial sampling: radiochemistry I, II, and III, tritium, general inorganics, stable isotopes, volatile organic compounds (VOC), and metals. Saturated zones: radionuclides (tritium, ^{90}Sr, ^{137}Cs, ^{241}Am, plutonium isotopes, uranium isotopes, gamma spectrometry and gross alpha, beta, and gamma), stable isotopes (hydrogen, oxygen, and in special cases nitrogen), major ions (cations and anions), trace metals, and trace elements.	Anions, trace elements, VOCs, SVOCs, HE, dissolved organic carbon, total suspended solids, neutral species, hardness, cyanide, stable and radiogenic isotopes (^{13,14}carbon, ^{36}chloride, D/H, ^{18}O/^{16}O), ^{241}Am, ^{137}Cs, ^{238}Pu, ^{239,240}Pu, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{90}Sr, gamma spec, gross-alpha, -beta, -gamma, and tritium (low-detection limit)	Metals (dissolved), anions (dissolved), VOCs, ^{99}Tc, gamma spec, ^{241}Am, ^{137}Cs, ^{238}Pu, ^{239,240}Pu, ^{234}U, ^{235}U, ^{238}U, ^{90}Sr, stable isotopes (^{18}O/^{16}O, D/H, ^{15}N/^{14}N), tritium, tritium (low-level or direct counting), RV gross-alpha, beta, gamma	Following well completion and development, groundwater samples (from screens 2 and 3 were analyzed for inorganic and organic chemicals, tritium, radionuclides, stable isotopes, and anions.
Water Sample Field Measurements	Alkalinity, dissolved oxygen, pH, specific conductance, temperature, turbidity	Alkalinity, dissolved oxygen, pH, specific conductance, temperature, turbidity	Alkalinity, pH, specific conductance, temperature, turbidity	pH, specific conductance, temperature, turbidity
Number of Core/Cuttings Samples Collected for Contaminant Analysis	Twenty samples of core or cuttings to be analyzed for potential contaminant identification in each borehole.	Number of core/cuttings samples to be collected not specified	Core samples to be collected at target depths of 10, 20, 30, 40, 50, 75, 100, 150, 200, 300, and 400 ft	13 core/cuttings samples submitted for analysis
Core/Cuttings Sample Analytes	Upper-most core or cuttings sample to be analyzed for a full range of compounds; deeper samples to be analyzed for the presence of radiochemistry I, II, and III analytes, tritium (low- and high-detection levels), and metals. Four samples to be analyzed for VOCs.	Upper-most core or cuttings sample to be analyzed for a full range of compounds; deeper samples to be analyzed for major and minor anions, trace elements, and tritium (low- and high-detection limit), as well as other contaminants of potential concerns (COPCs) appropriate for that location. In addition, selected samples will be analyzed for VOCs and semivolatile organic compounds (SVOCs).	Analytical suite for core/cuttings samples includes anions, stable isotopes, tritium profiles, ^{241}Am, ^{238}Pu, ^{239,240}Pu, ^{234}U, ^{235}U, ^{238}U, ^{90}Sr, gamma spectroscopy, radiological screening (gross alpha, beta, and gamma), radionuclides, and metals.	Samples submitted for anions and radionuclides.

Activity	"Hydrogeologic Workplan" (LANL 1998, 59599)	"Pajarito Canyon Workplan" (LANL 1998, 58820)	R-20 Sampling and Analysis Plan	R-20 Actual Work
Laboratory Hydraulic-Property Tests	Physical properties analyses will be conducted on 5 core samples and will typically include moisture content, porosity, particle density, bulk density, saturated hydraulic conductivity, and water retention characteristics.	Retrieved core and cuttings samples will be analyzed for moisture content, at 10-ft intervals, except where saturation is encountered. Hydraulic properties analyses will be conducted on core samples based on geologic and hydrologic conditions encountered.	Core samples for anion profiles will be measured for moisture content.	13 samples submitted for moisture analysis. Other properties may be inferred from geophysics.
Geophysics	In general, open-hole geophysics includes caliper, electromagnetic induction, natural gamma, magnetic susceptibility, borehole color videotape (axial and side scan), fluid temperature (saturated), fluid resistivity (saturated), Single-point resistivity (saturated), and spontaneous potential (saturated). In general, cased-hole geophysics includes: gamma-gamma density, natural gamma, and thermal neutron.	Portions of the borehole may be logged with open-hole tools if borehole stability is such that the borehole can be advanced without casing. Cased-hole wire line logging will be conducted in the cased-off borehole and well.	The number and types of logs will vary as a function of borehole condition and the presence or absence of drill or well casing. In general, open-hole geophysics includes caliper, array induction, triple lithodensity, combinable magnetic resonance, natural gamma, natural gamma ray spectrometry, epithermal compensated neutron, Mechanical sidewall coring tool, fullbore formation microimager, and borehole color videotape (axial and side scan). In general, cased-hole geophysics includes: triple lithodensity, natural gamma ray spectrometry, natural gamma, and epithermal compensated neutron.	LANL tools: natural gamma, induction; borehole video Schlumberger geophysics: NGS, AITH™, TLD™, ECS™, CMR™, FMI™, DSLT
Water-Level Measurements	Procedures and methods not specified	Not specified	Water levels will be determined for each saturated zone by water-level meter or by pressure transducer.	Water-level meter determined water levels for the regional water table.

Activity	"Hydrogeologic Workplan" (LANL 1998, 59599)	"Pajarito Canyon Workplan" (LANL 1998, 58820)	R-20 Sampling and Analysis Plan	R-20 Actual Work
Field Hydraulic-Property Tests	Tests to be conducted not specified	Not specified	Straddle-packer/injection tests will be performed in all screens completed below the regional water table.	Constant-rate injection tests were conducted on screens 1, 2, and 3.
Surface Casing	Approximately 20-in. outer diameter (OD), extends from land surface to 10-ft depth in underlying competent layer and grouted in place.	Not specified	Install 18-in. or 20-in.-OD steel casing to approximately 60 ft.	18.375-in.-OD steel casing set at 80 ft, cemented in place
Conductor Casing	Unless other technical methods are applied, a temporary steel casing, up to 14-in.-OD, will be advanced to total depth of borehole.	Not specified	Install 11.75-in.-OD drill casing from 0 to ~700 to 800 ft bgs, or approximately 100 ft above anticipated regional water level, or set thin-wall casing over problem zone(s) and seal off casing using materials to meet regulatory requirements.	13.375-in.-OD-drill casing from 0 to 780 ft bgs
Minimum Well Casing Size	6 5/8-in. OD	Not specified	5-in. OD	5-in.-OD by 4.5-in.-inner diameter (ID) stainless steel casing w/ external couplings
Well Screen	Machine-slotted (0.01-in.), stainless steel screens with flush-jointed threads; number and length of screens to be determined on a site-specific basis and proposed to NMED.	Not specified	Well screen shall be constructed with multiple sections of 5.5-in. OD stainless steel pipe with wire wrap (0.010-in. slot opening).	Screened intervals constructed of 5.56-in.-OD (4.5-in.-ID) pipe based, stainless steel, wire-wrapped, 0.010-in. slotted screen

Activity	"Hydrogeologic Workplan" (LANL 1998, 59599)	"Pajarito Canyon Workplan" (LANL 1998, 58820)	R-20 Sampling and Analysis Plan	R-20 Actual Work
Filter Material	>90% silica sand, properly sized for the 0.010-in. slot size of the well screen; extends 2 ft above and below the well screen	Not specified	Filter pack shall extend at least 5 ft and no more than 10 ft above and below each well screen. No differentiation made between primary and secondary filter packs.	Primary filter pack consisted of 20/40 silica sand placed 8 ft below and 8.2 ft above screen 3. Secondary filter pack consisted of 30/70 silica sand placed in a layer 2-ft-thick below and 2.3-ft-thick above. Primary filter pack consisted of 20/40 silica sand placed 10.8 ft below and 14.6 ft above screen 2. Secondary filter pack consisted of 30/70 silica placed in a layer 2.1-ft-thick below and 2.2-ft-thick above. Primary filter pack consisted of 20/40 silica sand placed 14.3 ft below and 9.4 ft above screen 1. Secondary filter pack of 30/70 silica sand placed in a layer 3.5-ft-thick below and 2.1-ft-thick above.
Annular Fill Material (exclusive of filter materials)	Uncontaminated drill cuttings below sump and bentonite above sump	Not specified	Bentonite and cement in borehole or well annulus.	Slough in bottom of borehole and bentonite seals below and above screens 3, 2, and 1 filter packs Cement plug from 767 to 788.7 ft bgs Cement-bentonite grout from surface to 75.2 ft bgs
Sump	Stainless steel casing with an end cap	Not specified	Not specified	5-in. diameter stainless steel casing, 16.8-ft-long, with an end cap.
Bottom Seal	Bentonite	Not specified	Bentonite	Bentonite

Appendix B

Drill-Additive Product Specifications
(CD attached to inside back cover)

QUIK-GEL®

Viscosifier

Description

QUIK-GEL is an easy-to-mix, finely ground (200-mesh), premium-grade, high-yielding Wyoming sodium bentonite. QUIK-GEL imparts viscosity, fluid loss control and gelling characteristics to freshwater-based drilling fluids.

Applications/Functions

- Mix with fresh water to form a low-solids drilling flluid for general drilling applications
- Viscosify water-based drilling fluids
- Reduce filtration by forming a thin filter cake with low permeability
- Improve hole-cleaning capability of drilling fluids
- Mix with foaming agents to make "gel/foam" drilling fluids for air/foam drilling applications

Advantages

- ANSI/NSF Standard 60 certified
- Single-sack product and cost effective
- Provides lubricity for drilling fluids
- Mixes easily and quickly reaches maximum viscosity
- Yields more than twice as much mud of the same viscosity as an equal weight of API oilfield grades of bentonite

Typical Properties

Appearance	Grey to tan powder
Bulk density, lb/ft^3	68 to 72 (compacted)
pH (3% solution)	8.9

Recommended Treatment

Mix slowly through a jet mixer or sift slowly into the vortex of a high-speed stirrer.

Approximate Amounts of QUIK-GEL Added to Freshwater			
Application/Desired Result	**lb/100 gal**	**lb/bbl**	**kg/m^3**
Normal Drilling Conditions	15-25	6-10	18-30
Unconsolidated Formations	35-50	15-21	42-60
Make-Up For Gel/Foam Systems	12-15	5-7	14-18

- 1 bbl = 42 U.S. gallons

Additional Information

***Note*:**

- For optimum yield, pre-treat make-up water with 1-2 pounds of soda ash per 100 gallons of water (1.2-2.4 kg/m^3).

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Packaging QUIK-GEL® is packaged in 50-lb (22.7-kg) multiwall paper bags.

Availability QUIK-GEL can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

Baroid Industrial Drilling Products,

A Product and Service Line of Halliburton Energy Services, Inc.

3000 N. Sam Houston Pkwy. E.

Houston, TX 77032

Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
Technical Service	(877) 379-7412 Toll Free	(281) 871-4613

QUIK-FOAM®

High Performance Foaming Agent

Description

QUIK-FOAM, a proprietary blend of alcohol ethoxy sulfates (AES) which are biodegradable, is an effective foaming agent. QUIK-FOAM can be added to fresh, brine, or brackish water for air/foam, air/gel-foam, or mist drilling applications.

Applications/Functions

- Enhance the rate of cuttings removal
- Increase the ability of lifting large volumes of water
- Improve hole-cleaning capability of the airstream
- Reduce the sticking tendencies of wet clays, thereby eliminating mud rings and wall packing
- Reduce erosion of poorly consolidated formations
- Provide a technique for drilling in zones with lost circulation
- Increase borehole stability
- Reduce air-volume requirement
- Suppress dust during air drilling operation

Advantages

- ANSI/NSF Standard 60 Certified
- High quality, high expansion foam with a consistency similar to shaving foam
- High stability with excellent retention time
- Versatile and compatible with various types of make-up water
- Readily undergoes primary and ultimate (>99%) biodegradation
- Proven product for multi-discipline application

Typical Properties

Appearance	Light yellow, transparent liquid
Specific gravity	1.03
pH (0.5% solution)	7.1
Flash point, PMCC °F, °C	82, (28)
Pour point, °F, °C	0, (-18)

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Recommended Treatment

Approximate Amounts of QUIK-FOAM® Added to Injection Water			
Application	**Amount/100 gal**	**Amount/bbl**	**Liters/m^3**
Dry-air drilling (as a dust suppressant)	0.5 - 1 pints	0.2 - 0.5 pints	0.5 - 1.5
Mud-mist drilling in sticky clays	1 - 2 quarts	1 - 2 pints	2.5 - 5
Foam and gel-foam drilling	0.5 - 2 gallons	1.5 - 7 pints	5 - 20
As a slug to clean the annulus	1 pint*	0.5 pints*	0.5**

* in drill pipe, followed by 3 to 5 gallons of water; ** followed by 20 liters of water

Note:

Close product container immediately after use to avoid gelation of remaining QUIK-FOAM.

Product Make-ups for Air Drilling Injection Slurries				
Main Ingredient of Injection Slurry	**Water (gallons)**	**QUIK-GEL® viscosifier (pounds)**	**QUIK-TROL® polymer (pounds)**	**QUIK-FOAM foaming agent (% by volume)**
Foam Drilling System	100	…	…	0.02 - 3.0
Mixing/Injection Procedure Add QUIK-FOAM to injection water. Inject into the air stream at a rate necessary to maintain hole stability and penetration rate. Increase amount of QUIK-FOAM as required to compensate for downhole water dilution				
Firm-Foam Drilling System	100	…	0.5 - 1	0.1 - 2.0
Mixing/Injection Procedure Mix polymer with water before adding QUIK-FOAM. 1-2 pints of EZ MUD® may be used as a substitute for QUIK-TROL. Inject into the air stream at a rate necessary to maintain hole stability and penetration rate.				
Mud-Mist Drilling System	100	25	…	0.3 - 1.0
Mixing/Injection Procedure Mix viscosifier with water before adding QUIK-FOAM. Inject into the air stream at a rate necessary to maintain hole stability and penetration rate. Resulting viscosity is 32-40 sec/qt as measured by Marsh Funnel.				
Gel-Foam Drilling System	100	12 - 15	1	0.3 - 1.0
Mixing/Injection Procedure Mix viscosifier and polymer with water before adding QUIK-FOAM. Inject into the air stream at a rate necessary to maintain hole stability and penetration rate. Resulting viscosity is 32-40 sec/qt as measured by Marsh Funnel.				

Note:

In some states, it is illegal to discharge any foreign substance into the water shed due to potential contamination of ground water. After use, the foam mixture must be localized in an earthen pit or some type of containment and allowed to biodegrade naturally.

Packaging QUIK-FOAM® is packaged in 5-gal (19-liter) plastic containers or in 55-gal (208 liter) drums.

Availability QUIK-FOAM can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
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PAC™-L

Modified Natural Cellulosic Polymer

Description

PAC-L, modified natural cellulosic polymer, provides filtration control in most water-based drilling fluids without substantially increasing viscosity. PAC-L, when added to a QUIK-GEL® or BORE-GEL™ slurry, yields a drilling mud system suitable for drilling in sandy formation. PAC-L can be added to vegetable or mineral oil to provide an oil-based fluid suspension, which can be poured into drill string directly.

Applications/Functions

- Provide filtration control in fresh or brackish water-based drilling fluids
- Reduce fluid loss without significantly increasing fluid viscosity
- Encapsulate shale to prevent swelling and disintegration
- Promote borehole stability in water sensitive formations
- Minimize rod chatter, rotational torque and circulating pressure
- Improve hole cleaning and core recovery

Advantages

- Effective in fresh water, salt water and brackish water-based drilling fluids
- Effective in small quantities for filtration control
- Non-fermenting
- Compatible with other Baroid drilling fluid additives
- Resistant to harsh environments and contaminants

Typical Properties

Appearance	White, free-flowing powder
pH (1% aqueous solution)	7.75

Recommended Treatment

- Using a Venturi Mixer, or into vortex of a high-speed stirrer, add slowly and uniformly to the entire circulating system.

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Recommended Treatment

Approximate Amounts of PAC™-L Added to Water Based Fluids		
Desired Condition/Result		
Added to fresh or salt water	**lb/100 gal**	**kg/m^3**
Ÿ To stabilize water sensitive formation	3 – 7	4 – 8.5
Ÿ To reduce torque and lower circulating pressure	0.5 - 2	0.6 – 2.4
Added to QUIK-GEL® slurry (25 lb/100 gallons) or (30 kilograms per m^3)	**lb/100 gal**	**kg/m^3**
Ÿ To reduce filtration rate and improve borehole stability	0.5 - 2.0	0.6 – 2.4
Added to BORE-GEL™ slurry (35 lb/100 gallons) or (42 kilograms per m^3)	**lb/100 gal**	**kg/m^3**
Ÿ To reduce filtration rate and improve borehole stability	0.5 – 2.0	0.6 – 2.4

Note:
Very salty waters may require twice as much PAC-L as fresh water. Preferably, PAC-L should be mixed in fresh water before it is added to very salty water.

Packaging

PAC-L is packaged in 50-lb (22.7 kg) bags.

Availability

PAC-L can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
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N-SEAL™

Lost Circulation Material

Description

N-SEAL, acid soluble lost circulation material, is specially formulated extrusion spun mineral fiber. Due to its solubility in weak acids, N-SEAL is easily removed from production zones.

Applications/Functions

N-SEAL can be used in concentrations of up to 70 lb/100 gallons (86 kg/m^3) in slug treatments or as additive to entire system.

Advantages

- Acid soluble
- Easily-wetted
- Inorganic and non-fermenting

Typical Properties

Appearance	Gray white fiber
Specific gravity	2.6

Recommended Treatment

N-SEAL can be added directly through the hopper.

- For normal treatment to the active system, add 5-20 lb/100 gallons drilling fluid (6-24 kg/m^3)
- As a pill, add 20-70 lb/100 gallons of drilling fluid (24-86 kg/m^3)

N-SEAL is 95% acid soluble. To dissolve 1 lb of N-SEAL, treat with either

- 1-2 lb AQUA-CLEAR™ MGA (1-2 kg/kg)

  or
- 0.5-1 gal of 10% HCl/5% Acetic acid blend (1-2 liters/kg)

Packaging

N-SEAL is packaged in 30-lb (13.6 kg) multiwall paper bags.

Availability

N-SEAL can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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LIQUI-TROL™

Modified Cellulosic Polymer Suspension

Description

LIQUI-TROL is a free-flowing, liquid suspension of a modified natural cellulosic polymer, in an ultra-clean oil. LIQUI-TROL, when added to a QUIK-GEL® or BORE-GEL™ slurry, yields a drilling mud system suitable for drilling in water sensitive formations.

Applications/Functions

- Provide filtration control in fresh or brackish water-based drilling fluids
- Promote borehole stability in water sensitive formations
- Pour a slug of concentrate into drill string directly to sweep the hole
- Minimize rotational torque and circulating pressure
- Improve hole cleaning and core recovery
- Stiffen the foam to improve cuttings transport in air/gel-foam drilling
- Reduce air requirements, uphole velocity and borehole annulus pressure

Advantages

- Effective in fresh water, salt water and brackish water-based drilling fluids
- Effective in small quantities for filtration control
- Non-fermenting
- Compatible with other Baroid drilling fluid additives
- Resistant to harsh environments and contaminants

Typical Properties

Appearance	Off-white, free-flowing, viscous fluid
Specific gravity	0.98
pH (0.3% solution)	9.0
Flash point, PMCC °F (°C)	185, (85)
Pour point, °F (°C)	35, (1.7)
Freeze point, °F (°C)	-40, (-40)

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Recommended Treatment

- Using Venturi Mixer, or into vortex of a high-speed stirrer, add slowly and uniformly to entire circulating system.
- Used to slug down the rods to produce a high viscosity hole-cleaning sweep.

Approximate Amounts of LIQUI-TROL™ Added to Water-Based Fluids		
Desired Condition/Result		
Added to fresh or salt water	**qt/100 gal**	**liters/m^3**
• To stabilize water sensitive formation	4-6	10-15
• To reduce torque and lower circulating pressure	2-4	5-10
Added to QUIK-GEL® slurry (25 pounds per 100 gallons) (30 kilograms per m^3)	**qt/100 gal**	**liters/m^3**
• To enhance drilling mud fluid properties	1-2	2.5-5
• To improve drilling mud suspension and stabilization capabilities	2-4	5-10
Added to injection liquid in air/foam drilling	**qt/100 gal**	**liters/m^3**
• To improve foam performance and hole cleaning	1-4	2.5-10

Note:

Salt water may require twice as much LIQUI-TROL as fresh water. Preferably, LIQUI-TROL should be mixed in freshwater before it is added to salty water.

Packaging

LIQUI-TROL is packaged in 5-gal (19-liter) metal pails with an integrated, resealable pour spout.

Availability

LIQUI-TROL can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
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HOLEPLUG®

Graded Sodium Bentonite

Description

HOLEPLUG is a naturally occurring Wyoming sodium bentonite clay that is a sized and graded chip material used to seal and plug earthen boreholes.

HOLEPLUG is available in two particle size grades:

- HOLEPLUG 3/4" (100% of particles pass through 3/4" screen; all particles retained on 3/8" screen)
- HOLEPLUG 3/8" (100% of particles pass through 3/8" screen; all particles retained on 1/4" screen)

Applications/Functions

- Highly recommended for use in grouting annulus in all types of wells, particularly environmental monitoring well applications
- Seal above gravel packs
- Plug decommissioned boreholes
- Stemming shotholes
- Seal around conductor pipe
- Seal lost circulation zones
- Shut off artesian flow

Advantages

- Prevents entry of surface water into boreholes
- High swelling potential
- In situ swelling to provide a superior seal with excellent casing stabilization
- Easier to apply than pellets
- Cost effective
- Simple to apply, mixing not required
- Prevents vertical movement of fluids in the hole between porous zones
- Forms a permanent, flexible downhole seal
- Allows hole re-entry
- Rehydratable
- ANSI/NSF Standard 60 certified

Typical Properties

Volume of 50-lb (22.7 kg) sack	
HOLEPLUG 3/4"	0.73 ft^3 or 0.027 yd^3 or 0.021 m^3
HOLEPLUG 3/8"	0.70 ft^3 or 0.026 yd^3 or 0.020 m^3
Permeability	1.5×10^{-9} cm/sec (in fresh water)
Appearance	Beige to tan chips

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Recommended Treatment

Plugging and Stemming Drill Holes

Due to shipping and handling, a small amount of fine bentonite particles may be present. For optimum results, HOLEPLUG® should be poured over a mesh or screen with ¼" (6.4 mm) openings to "sift out" the smaller particles. The screen should be large enough (approx.1 yd^2 or $1m^2$) to be folded into a "V" shape to allow sifting while the product is being poured into the hole. Also, HOLEPLUG should be poured slowly. Allow approximately two minutes to pour a 50-lb (22.7 kg) bag.

1. Position the screen with the lower end placed over the borehole
2. Slowly pour HOLEPLUG down the "V" so that fine particles fall through the screen before the larger particles fall into the borehole
3. Fill hole as required (above static water level or to ground level)
4. Observe all regulatory specifications

Stopping loss of circulation and stabilizing unconsolidated formations

1. Pull drill pipe out of hole
2. Pour HOLEPLUG into hole to fill above problem zone
3. Drill ahead slowly with reduced pump pressure

Plugging flowing wells

Pour HOLEPLUG into hole until water flow subsides or hole is filled to surface.

Treatment Considerations

§ Adequate annular space should be present to allow for the placement of HOLEPLUG into the area of concern without bridging. It is recommended that a minimum annular space of two inches on either side of the outside dimension of the casing be present. This will facilitate the placement of tremie lines and reduce the potential of the HOLEPLUG bridging during pouring operations. The use of this product should always correspond with applicable federal, state and local well construction guidelines.

Application Amounts

Amounts of HOLEPLUG® Required for Plugging Applications				
Hole Diameter (inches)	Hole Volume (ft^3/ft)	Pounds HOLEPLUG Needed to Fill One Foot	Feet Filled by One Bag HOLEPLUG	Bags HOLEPLUG Needed to Fill 100 ft
2	0.022	1.6	32.6	3.2
2.5	0.034	2.4	20.5	5.0
3	0.049	3.5	14.3	7.0
3.5	0.067	4.8	10.4	9.6
4	0.087	6.3	7.9	12.6
4.5	0.110	7.9	6.3	15.8
5	0.136	9.8	5.1	19.6
5.5	0.165	11.9	4.2	23.8
6	0.196	14.1	3.5	28.2
6.5	0.230	16.6	3.0	33.2
7	0.267	19.2	2.6	38.4
7.5	0.307	22.1	2.3	44.2
8	0.349	25.1	2.0	50.2
8.5	0.394	28.4	1.8	56.8
9	0.442	31.8	1.6	63.6
9.5	0.492	35.4	1.4	70.8
10	0.545	39.2	1.3	78.4
11	0.660	47.5	1.1	95.0
12	0.785	56.5	0.89	113.0
15	1.227	88.3	0.57	176.6
18	1.767	127.2	0.39	254.4
20	2.182	157.1	0.32	314.2
25	3.409	245.4	0.20	490.8
30	4.909	353.4	0.14	706.8

Application Amounts (metric equivalents)

Amounts of HOLEPLUG® Required for Plugging Applications				
Hole Diameter (mm)	Hole Volume (m^3/m)	Kilograms HOLEPLUG Needed to Fill One Meter	Meters Filled by One Bag HOLEPLUG	Bags HOLEPLUG Needed to Fill 10 meters
51	0.002	2.3	9.87	1.0
64	0.003	3.6	6.31	1.6
76	0.005	5.2	4.38	2.3
89	0.006	7.0	3.22	3.1
102	0.008	9.2	2.47	4.1
114	0.010	11.6	1.95	5.1
127	0.013	14.4	1.58	6.3
140	0.015	17.4	1.30	7.7
152	0.018	20.7	1.10	9.1
165	0.021	24.3	0.93	10.7
178	0.025	28.2	0.81	12.4
191	0.029	32.4	0.70	14.3
203	0.032	36.8	0.62	16.2
216	0.037	41.6	0.55	18.2
229	0.041	46.6	0.49	20.5
241	0.046	51.9	0.44	22.9
254	0.051	57.5	0.39	25.3
279	0.061	69.6	0.33	30.7
305	0.073	82.8	0.27	36.5
381	0.114	129.4	0.18	57.0
457	0.164	186.4	0.12	82.1
508	0.203	230.1	0.10	101.4
635	0.317	359.5	0.06	158.4
762	0.456	517.7	0.04	228.1

Packaging

HOLEPLUG graded bentonite is packaged in 50-lb (22.7 kg) multiwall paper bags.

Availability

HOLEPLUG can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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Technical Service	(877) 379-7412 Toll Free	(281) 871-4613

EZ-MUD®

Polymer Emulsion

Description

EZ-MUD, a liquid polymer emulsion containing partially hydrolyzed polyacrylamide/polyacrylate (PHPA) copolymer, is used primarily as a borehole stabilizer to prevent reactive shale and clay from swelling and sloughing. EZ-MUD is also added to low-solids drilling fluids to increase lubricity, fluid viscosity, and to improve carrying capacity of air/foam injection fluids.

Applications/Functions

- Stabilize reactive shale and clay formations
- Improve borehole stability
- Enhance slurry rheological properties
- Alleviate mud rings, bit balling and booting-off in clay formations
- Reduce drill pipe torque and pumping pressure
- Minimize rod chatter in diamond core drilling
- Create "stiff-foam" and maintain foam integrity
- Flocculate non-reactive solids in reserve pit at low concentrations

Advantages

- Mixes easily with minimum shear in fresh water
- Provides effective clay and shale stabilization with lower viscosity
- Imparts high degree of lubricity
- Non-fermenting
- Breaks down chemically with bleach (sodium hypochlorite)
- ANSI/NSF Standard 60 Certified

Typical Properties

Appearance	Thick, opaque white liquid
Density	8.5 lb/gal (1.02 g/cm^3)
pH (1 quart per 100 gallons water)	8.5
Flash point, PMCC °F, °C	>200 (>93.3)
Thermal stability, °F, °C	250 (121)

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Recommended Treatment

Approximate Amounts of EZ-MUD® Added to Drilling Fluid System			
Drilling Application/Desired Property	**Quarts/ 100 gal**	**Pints/bbl**	**Liters/m^3**
Added to fresh water (To formulate a clay-free drilling fluid)			
• To stabilize reactive clay and shale	0.5 - 2.0	0.5 - 1.75	1.25 - 5.0
• To retard rod vibration, reduce torque and pumping pressure	1.0 - 2.0	1.0 - 1.75	2.5 - 5.0
Added to QUIK-GEL® or BORE-GEL™ Drilling Fluids			
• To retard reactive shale and clay and enhance lubricity	0.5 - 1.0	0.5 - 1.0	1.25 - 2.5
Added to injection liquid in air/foam drilling applications			
• To improve foam performance and hole conditions	0.5 - 1.0	0.5 - 1.0	1.25 - 2.5

Notes:

- Make-up water used to mix EZ-MUD should meet the following quality:
  total chloride less than 1500 ppm (mg/L)
  total hardness less than 150 ppm as calcium
  total chlorine less than 50 ppm
  water pH between 8.5-9.5
- Reduce total hardness of make-up water by adding soda ash (sodium carbonate) at 0.5 to 1 pound per 100 gallons (0.6 - 1.2 kg/m^3) of make-up water.
- EZ-MUD can be chemically broken down with liquid bleach in regular household concentration (5% sodium hypochlorite). Use one gallon of liquid bleach per 100 gallons (10 liters/m^3) of fluid formulated with EZ-MUD. Do not use perfumed liquid bleach or solid calcium hypochlorite.

Packaging

EZ-MUD is packaged in 5-gal (19-liter) and 1-gal (3.8-liter) plastic containers.

Availability

EZ-MUD can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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BENSEAL®

Sealing and Plugging Agent

Description

BENSEAL is a granular (8-mesh), natural Wyoming sodium bentonite for use in sealing and grouting well casings and earthen structures. BENSEAL is not recommended for use as a drilling mud.

Applications/Functions

- Seal or grout plastic or steel casings in monitor and water well construction
- Seal or plug abandoned boreholes
- Seal leaking ponds, ditches and dams
- Soil stabilization
- Prepare BENSEAL/EZ-MUD® grouting system
- Aid in controlling loss of circulation

Advantages

- High swelling capacity
- Uniform particle size
- No heat of hydration
- Prevents commingling of aquifers and contamination from surface
- Forms a flexible seal to protect casing from corrosive contaminants
- Allows for hole re-entry
- ANSI/NSF Standard 60 certified

Typical Properties

Appearance	Bluish to gray granules
Dry screen analysis	85% of 8 mesh
Volume, ft^3/sack	0.7 (as packaged)
Specific gravity	2.6
Permeability	less than 1×10^{-8} cm/sec (in fresh water)

Recommended Treatment

As a casing drill and drive operation:

1. Dig a cone-shaped depression around casing. Depression should be 6 - 8 inches (152-203 mm) larger than the outside diameter of the casing and 2 - 3 feet (60-75 cm) deep.
2. Keep cone-shaped depression filled with dry BENSEAL while driving the casing.

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Recommended Treatment (continued)

Note:

When drilling and driving a 4" (102mm) pipe, expect to use 2.5 pounds of BENSEAL® per foot of hole or 3.7 kilograms of BENSEAL per meter of hole.

Sealing ponds or earthen structures:

Depending on the native soil, disc in or mix 3 to 5 pounds of BENSEAL per square foot (14-24 kg/m^2) uniformly over the area to be sealed so that a 6-inch (~152 mm) blanket of soil and BENSEAL is formed. Do not neglect the edges of the dam or the sides/walls of the pond. This sealing blanket should then be compacted in place and as a further protection to the sealing blanket, 2 to 4 inches (51-102 mm) of local soil or sand should cover the sealing blanket and be compacted.
If the leaking area can be identified and isolated, an attempt can be made to broadcast BENSEAL uniformly at 4 to 6 pounds of BENSEAL per square foot (20-30 kg/m^2) of surface area into the water over the area of concern.
Note*:* Bentonite is more effective as a sealing agent when confined. Therefore, every effort should be made to cover the BENSEAL after it is broadcast with a 2-3 inch (51-76 mm) layer of sand. This will reduce the potential for dispersion into the water and un-yielded bentonite particles interfering with the gill action of fish.

Lost returns (moderate):

1. Begin with the pit full of mud.
2. Raise the pump suction off bottom and place a shovel next to it and slightly under suction.
3. Pour dry BENSEAL slowly into the space between shovel and suction and pump it down the hole.

Packaging

BENSEAL is packaged in 50-lb (22.7 kg) multiwall paper bags, containing 0.7 ft^3 (0.02 m^3).

Availability

BENSEAL can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

Baroid Industrial Drilling Products,
A Product and Service Line of Halliburton Energy Services, Inc.
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Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
Technical Service	(877) 379-7412 Toll Free	(281) 871-4613

AQUA-CLEAR™ PFD

Phosphate-Free Dispersant

Description

AQUA-CLEAR PFD is a concentrated liquid polymer dispersant that provides superior mud and sediment removal from the producing formation and gravel pack. This product is also a highly effective mud thinner. AQUA-CLEAR PFD contains no phosphates.

Applications/Functions

- Disperse mud, sediment and clay from the producing formation and gravel pack in the screened interval.
- Reduce viscosity and gel strength of drilling fluids

Advantages

- ANSI/NSF Standard 60 certified
- Reduces development time
- Increases well yield and capacity
- Safe to use on most plastics, rubber and metals
- Non-fermenting
- Reduces pumping costs

Typical Properties

Appearance	straw colored liquid
Specific gravity	1.2 to 1.4
pH (neat)	6.5 to 7.5

Recommended Treatment

As a Well Development Aid

- Determine volume of water in screen area and double the calculated volume to account for water in gravel pack and formation interface ***or*** determine the static volume of water and add 50% excess.
- Once the water volume is determined, calculate the required treatment volume of AQUA-CLEAR PFD by the following formula:

  AQUA-CLEAR PFD (gal or L) = 0.002 x Water Volume (gal or L)

This equates to one gallon of AQUA-CLEAR PFD for every 500 gallons of water (0.2% by volume) or 2.0 liters of AQUA-CLEAR PFD for every cubic meter of water.

- Mix thoroughly before introducing into well.
- The preferable application method utilizes a tremie line with the product applied into the screened area.
- If necessary, the AQUA-CLEAR PFD/water solution may be poured into the well.
- Mixture should be thoroughly blended in well, then agitated using a surge

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Recommended Treatment (continued)

and swab, jetting, or other developmental technique repeatedly every two hours for a period of up to 24 hours.

- Pump to waste until turbidity clears up and then connect well to distribution system.

As a Mud Thinner

- Start by adding one pint of AQUA-CLEAR™ PFD to 500 gallons of mud. Increase concentration until desired viscosity is achieved.

Well Capacity Chart (Gallons per Foot)					
Well Diameter (Inches)	**Well Capacity in Gallons/ft**	**Well Diameter (Inches)**	**Well Capacity in Gallons/ft**	**Well Diameter (Inches)**	**Well Capacity in Gallons/ft**
2	0.2	12	5.9	24	23.5
4	0.7	14	8.0	26	27.6
6	1.5	18	13.2	30	36.7
8	2.6	20	16.3	36	52.9
10	4.1	22	19.7	48	94.0

Well Capacity Chart (Liters per Meter)					
Well Diameter (millimeters)	**Well Capacity Liters/meter**	**Well Diameter (millimeters)**	**Well Capacity Liters/meter**	**Well Diameter (millimeters)**	**Well Capacity Liters/meter**
51	2.0	305	73.0	610	292.0
102	8.1	356	99.3	660	342.6
152	18.3	457	164.2	762	456.1
203	32.4	508	202.7	914	656.8
254	50.7	559	245.3	1219	1167.7

Note: The volumes in these tables show only the volume of water in a 1 foot or 1 meter section of a given size of screen. Excess volume must be included to account for water present in the formation interface and gravel pack.

Packaging

AQUA-CLEAR PFD is packaged in a 5-gal (19-liters) plastic pail or 1-gal (3.8-liter) plastic container.

Availability

AQUA-CLEAR PFD can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you, contact the Customer Service Department in Houston or your area IDP Sales Representative.

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AQUA-CLEAR™ MGA

Modified Granular Acid

Description

AQUA-CLEAR MGA is a dry blend of granular acid and additives used in the removal of iron, manganese and carbonate scale. It retains strength longer than most liquid acids, which increases its cleaning capability.

Applications/Functions

- Disperse scale and incrustation
- Remove scale and incrustation from the water well screen, casing, gravel pack and pumping equipment
- Restore well production
- AQUA-CLEAR MGA can be used in combination with AQUA-CLEAR AE to remove more difficult scale and incrustation

Advantages

- ANSI/NSF Standard 60 certified
- Safe to use on all plastics, rubber and metals
- No harmful vapors
- Improves water quality (color, taste and appearance)
- Reduces equipment and piping failures due to scale build-up and corrosion
- Reduces pumping costs

Typical Properties

Appearance	Free-flowing, off-white granules
Specific gravity	2.00
pH (10% solution)	0.9
Solubility in water	Complete with slight to hazy turbidity

Recommended Treatment

- Record initial well water pH
- The preferred application method is to apply a solution of AQUA-CLEAR MGA into the screened interval through a tremie pipe.

Recommended Treatment (continued)

- Mix AQUA-CLEAR™ MGA with water at ½ - 1 pound per gallon of water or 0.06 - 0.12 kilograms per liter of water and apply directly into screened interval with a tremie pipe. When utilizing this method, calculate the volume of water in the screened area and double the calculated volume to account for the water in the gravel pack and formation interface.

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Note: The previous concentration of* AQUA-CLEAR™ MGA *is recommended for a complete reconditioning of an existing well.

- Calculation for volume in well:
- Gallons per foot = (diameter, inches)^2 x 0.042
- Liter per meter = (diameter, millimeters)^2 x 0.0008
- Displace solution into the well screen and formation, then surge, swab, agitate or jet well through screen and gravel pack for 20-30 minutes.
- Allow to stand in well for up to two hours and then repeat activity approximately every two hours for a period of 24 hours.
- Pump well to waste until well water pH is within 0.5 of original well pH.

  Note: Wastewater can be neutralized by adding soda ash or lime

- Chlorinate well and reconnect to water distribution system.

  Caution: Never mix chlorine and* AQUA-CLEAR MGA *in well.

- If necessary, AQUA-CLEAR MGA may be poured directly into well as per treatment table, but results will not be as good as if applied in a dissolved form via a tremie pipe. The undissolved form will require more mechanical agitation.

Note:

- ***In heavily encrusted wells, it is desirable to brush or scrape the casing and screen, then pump or airlift the debris to waste prior to treating with acid.***

The following charts recommend a concentration of* AQUA-CLEAR MGA *that is suitable for a typical maintenance treatment of an existing well.

AQUA-CLEAR MGA Application Amounts per 10 Feet of Standing Water					
Well Diameter (Inches)	**Pounds of Product**	**Well Diameter (Inches)**	**Pounds of Product**	**Well Diameter (Inches)**	**Pounds of Product**
2	0.35	12	12.73	24	50.94
4	1.41	14	17.33	26	59.78
5	2.21	16	22.64	28	69.33
6	3.18	18	28.65	30	79.60
8	5.66	20	35.37	36	114.61
10	8.84	22	42.80	48	203.75

Recommended Treatment (continued)

AQUA-CLEAR™ MGA Application Amounts per 10 Meters of Standing Water					
Well Diameter (millimeters)	**Kilograms of Product**	**Well Diameter (millimeters)**	**Kilograms of Product**	**Well Diameter (millimeters)**	**Kilograms of Product**
51	0.53	305	18.97	610	75.90
102	2.11	356	25.83	660	89.10
127	3.29	406	33.73	711	103.31
152	4.74	457	42.69	762	118.60
203	8.43	508	52.71	914	170.77
254	13.18	559	63.78	1219	303.60

Note: The concentrations of* AQUA-CLEAR MGA *shown in the previous tables do not take into account the 100% excess volume required to compensate for the water present in the formation interface and gravel pack. The previous tables only account for the product concentration required for the volume of water occupying a 10 foot or 10 meter section of a given size of screen.

For other diameters:

- Gallons per foot = (diameter, inches)^2 x 0.042
- Liter per meter = (diameter, millimeters)^2 x 0.0008
- Pounds of AQUA-CLEAR MGA = (gallons per foot x 8.34) x 0.026
- Kilograms of AQUA-CLEAR MGA = (liters per meter) x 0.026
- Double the calculated volume in order to take into account the water present in the gravel pack and formation interface.
- AQUA-CLEAR AE can be used with AQUA-CLEAR MGA for iron bacteria treatment. When used together, utilize one gallon of AQUA-CLEAR AE for every 10 pounds of AQUA-CLEAR MGA or 0.84 liters of AQUA-CLEAR AE for every kilogram of AQUA-CLEAR MGA.

Safety

- AQUA-CLEAR MGA is safe to handle when in dry form, but when mixed with water it should be handled in accordance with recognized standard practices for handling corrosive and acidic materials (refer to Material Safety Data Sheet).
- Avoid skin and eye contact – flush with water
- Do not ingest and avoid prolonged inhalation
- When disposing of waste fluid make sure to comply with all federal, state and local regulations as applicable.

Packaging

AQUA-CLEAR™ MGA is packaged in 5-gal (19-liter) pails containing 50 pounds (22.7 kg) and in 1-gallon (3.8-liter) plastic jars containing 10 pounds (4.5 kg).

Shipping

The following are required for commercial transport:

- Insurance policy must include an endorsement for transporting hazardous cargo.
- Vehicle driver must have a Hazmat endorsement on his/her Commercial Drivers License.
- Hazardous Materials Certificate of Registration issued by the U.S. Department of Transportation (renewable annually) is required.
- Consult the state in which operating for any additional requirements that may exist.
- No hazardous materials placard is required for shipments less than 1000 pounds.

Availability

AQUA-CLEAR MGA can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

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AQUA-CLEAR™ AE

Acid Enhancer/Antifoulant

Description

AQUA-CLEAR AE is a liquid blend of acids and acid enhancers formulated to control bacterial slime contamination due to the presence of iron-related and sulphate-reducing bacteria.

Applications/Functions

- Remove the bio-mass matrix caused by bacterial fouling
- Reduce sulphur taste and odor in water
- Clean up well screens, pumps and distribution system
- Restore well productivity and reduce power and maintenance costs
- AQUA-CLEAR AE can be used in combination with AQUA-CLEAR MGA and other acids such as, hydrochloric (muriatic), phosphoric and sulfamic to enhance their effectiveness and to remove more difficult scale and incrustation

Advantages

- ANSI/NSF Standard 60 certified
- Safe to use on all plastics, rubber and metals
- Cost effective, efficient extended life treatment
- Improves water quality and renews well production rate
- Mitigates corrosion and equipment failure
- Reduces pumping costs

Typical Properties

Appearance	Light amber colored liquid
Specific gravity	1.08
pH of solution	1.1

Recommended Treatment

To treat bacteria fouling

- Record initial well water pH
- The preferred application method is to apply a solution of AQUA-CLEAR AE into the screened interval through a tremie pipe.

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Recommended Treatment (continued)

- Mix AQUA-CLEAR™ AE with water at 6 - 12 ounces per gallon of water or 47 - 94 ml per liter of water and apply directly into screened interval with a tremie pipe. When utilizing this method, calculate the volume of water in the screened area and double the calculated volume to account for the water in the gravel pack and formation interface.

Note: The above concentration of* AQUA-CLEAR AE *is recommended for a complete reconditioning of an existing well.

- Calculation for volume in well:
- Gallons per foot = (diameter, inches)^2 x 0.042
- Liter per meter = (diameter, millimeters)^2 x 0.0008
- Displace solution into the well screen and formation, then surge, swab, agitate or jet well through screen and gravel pack for 20-30 minutes.
- Allow to stand in well for up to two hours and then repeat activity approximately every two hours for a period of 24 hours.
- Pump well to waste until at least 23 well volumes have been removed and well water pH is within 0.5 of original well pH.

Note: Wastewater can be neutralized by adding soda ash or lime.

- Chlorinate well and reconnect to water distribution system.

Caution: Never mix chlorine and* AQUA-CLEAR AE *in well.

- If necessary, AQUA-CLEAR AE may be poured directly into well as per treatment table, but results will not be as good as if applied via a tremie pipe.

Notes:

- ***In heavily encrusted wells, it is desirable to brush or scrape the casing and screen, then pump or airlift the debris to waste prior to treating with acid.***
- ***The following charts recommend a concentration of* AQUA-CLEAR AE *that is suitable for a typical maintenance treatment of an existing well.***

AQUA-CLEAR AE Application Amounts per 10 Feet of Standing Water					
Well Diameter (Inches)	**Gallons of Product**	**Well Diameter (Inches)**	**Gallons of Product**	**Well Diameter (Inches)**	**Gallons of Product**
2	0.04	12	1.27	24	5.10
4	0.14	14	1.73	26	6.00
5	0.22	16	2.26	28	6.93
6	0.32	18	2.87	30	7.96
8	0.57	20	3.54	36	11.46
10	0.88	22	4.28	48	20.40

AQUA-CLEAR™ AE Application Amounts per 10 Meters of Standing Water					
Well Diameter (millimeters)	**Liters of Product**	**Well Diameter (millimeters)**	**Liters of Product**	**Well Diameter (millimeters)**	**Liters of Product**
51	0.49	305	17.60	610	70.35
102	1.95	356	23.94	660	82.57
127	3.05	406	31.27	711	95.76
152	4.40	457	39.57	762	109.93
203	7.82	508	48.86	914	158.29
254	12.21	559	59.12	1219	281.41

Recommended Treatment (continued)

Note: The concentrations of* AQUA-CLEAR AE *shown in the previous tables do not take into account the 100% excess volume required to compensate for the water present in the formation interface and gravel pack. The previous tables only account for the product concentration required for the volume of water occupying a 10 foot or 10 meter section of a given size of screen.

For other diameters:

- Gallons per foot = (diameter, inches)^2 x 0.042
- Liter per meter = (diameter, millimeters)^2 x 0.0008
- Gallons of AQUA-CLEAR AE = (gallons per foot x 8.34) x 0.0026
- Liters of AQUA-CLEAR AE = (liters per meter) x 0.0241
- Double the calculated volume in order to take into account the water present in the gravel pack and formation interface.

Treating Severe bio-fouling and scaling

- AQUA-CLEAR AE is used as an enhancer when mixed in the well with AQUA-CLEAR MGA
- One gallon of AQUA-CLEAR AE to every 10 pounds of AQUA-CLEAR MGA
- 3.8 liters of AQUA-CLEAR AE to every 4.5 kilograms of AQUA-CLEAR MGA

Safety

- Use recognized standard practices for handling corrosive and acidic materials (refer to Material Safety Data Sheet)
- Avoid skin and eye contact – flush with water
- Do not ingest and avoid prolonged inhalation
- When disposing of waste fluid make sure to comply with all federal, state and local regulations as applicable.

Packaging

AQUA-CLEAR™ AE is packaged in 1-gallon (3.8-liter) and 5-gallon (19-liter) plastic containers.

Shipping

- The following are required for commercial transport:
- Insurance policy must include an endorsement for transporting hazardous cargo.
- Vehicle driver must have a Hazmat endorsement on his/her Commercial Drivers License.
- Hazardous Materials Certificate of Registration issued by the U.S. Department of Transportation (renewable annually) is required.
- Consult the state in which operating for any additional requirements that may exist.
- No hazardous materials placard is required for shipments less than 1000 pounds.

Availability

AQUA-CLEAR AE can be purchased through any Baroid Industrial Drilling Products Distributor. To locate the Baroid IDP distributor nearest you, contact the Customer Service Department in Houston or your area IDP Sales Representative.

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Appendix C

Lithology Log

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Qal, Alluvium	No cuttings recovered in this interval.	0–25	6694.3–6669.3
	Volcaniclastic sediments, light brown (5YR 6/4), lithic-rich. +10F (i.e., plus No. 10 size sieved sample fraction): 97% broken light gray porphyritic dacite lithic fragments, limonite common on fractured surfaces; 3% quartz and sanidine crystals (up to 2.0 mm). +35F (i.e., plus No. 35 size sieved sample fraction): 70–80% dacite lithic fragments; 20–30% quartz and sanidine crystals.	25–35	6669.3–6659.3
	Volcaniclastic sediments, light olive-gray (5Y 6/1), lithic-rich. +10F: 98% broken light gray porphyritic dacite lithic fragments, most have iron oxide coating on fractured surfaces, most have bleached coloration; 2% quartz and sanidine crystals. +35F: 80% dacite lithic fragments; 20% quartz and sanidine crystals; no pumices.	35–45	6659.3–6649.3
	Volcaniclastic sediments, light olive-gray (5Y 6/1), lithic-rich. +10F: 99% broken light gray porphyritic dacite lithic fragments (most have Fe-oxide coatings on fractured surfaces and bleached coloration), minor rhyodacite, rare quartzite; 1–5% quartz and sanidine crystals; no pumices. +35F: 90% dacite lithic fragments; 10% quartz and sanidine crystals; no pumices.	45–55	6649.3–6639.3
	Volcaniclastic sediments, light olive-gray (5Y 6/1), lithic-rich. +10F: 97–98% light gray porphyritic lithic fragments that are broken to subangular, most have bleached coloration; minor latite and rhyodacite; 2–3% quartz and sanidine crystals; no pumices. +35F: 95% volcanic lithic fragments; 5% quartz and sanidine crystals; no pumices.	55–65	6639.3–6629.3
	Volcaniclastic sediments, light brown (5YR 6/4), lithic-rich. +10F: 95–97% volcanic lithic fragments that are broken to subangular chips (less than 3 mm), gray porphyritic dacite much more common than rhyolite, minor indurated tuffaceous sediments; 2–5% quartz and sanidine crystals; no pumices. +35F: 65% volcanic lithic fragments; 35% quartz and sanidine crystals; no pumices. Note: Qal/Qbt contact is estimated at 68 ft bgs	65–75	6629.3–6619.3
Qbt, Tshirege Member, Bandelier Tuff (Undivided)	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic-rich. +10F: 95–97% volcanic lithic fragments that are broken to subangular chips, gray to whitish (bleached) dacite more common than rhyolite, minor tuffaceous sandstone; 3–5% quartz and sanidine crystals; pumices absent. +35F: 35% volcanic lithic fragments; 65% quartz and sanidine crystals; pumices absent.	75–85	6619.3–6609.3
	No cuttings recovered in this interval.	85–100	6609.3–6594.3
	Rhyolite tuff, pinkish-gray (5YR 8/1), pumice-rich, clayey or vitric ash matrix. +10F: 99% broken chips of whitish-pumices (up to 1.7 cm) with minor alteration to clay; 1% dacite lithic fragments. +35F: 38% pumices; 60% phenocrysts; 2% lithic fragments.	100–105	6594.3–6589.3
	Rhyolite tuff, pinkish-gray (5YR 8/1), pumice and lithic fragment-rich. +10F: 60% pumice fragments (up to 1.0 cm), with minor alteration to clay; 40% volcanic lithic fragments, mostly gray and pink dacite, rare basalt fragments.	105–110	6589.3–6584.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Qbt, Tshirege Member, Bandelier Tuff (Undivided)	Rhyolite tuff, pinkish-gray (5YR 8/1), pumice and lithic fragment-rich, clayey ash matrix. +10F: 65% coarse pumice fragments (up to 1.2 cm), slight clay alteration; 30–35% volcanic lithic fragments, mostly subangular gray and pink dacite (up to 1.0 cm). +40F: 15–25% pumice; 60–70% phenocrysts; 3–5% lithic fragments.	110–120	6584.3–6574.3
	Rhyolite tuff, pinkish-gray (5YR 8/1), pumice-rich, clayey ash matrix. +10F: 75% pumice fragments (up to 1.0 cm) unaltered to clay alteration evident; 10% phenocrysts; 15% lithic fragments, mostly subangular gray dacite (up to 0.5 cm). +40F: 30% pumice; 65% phenocrysts; 5% lithic fragments.	120–125	6574.3–6569.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), pumice-rich, clayey ash matrix. +10F: 97–99% pumice fragments (up to 1.0 cm), earthy to frothy vitric texture; no phenocrysts evident; 1–3% lithic fragments. +40F: 10–25% pumice; 75–85% phenocrysts; 2–3% lithic fragments.	125–135	6569.3–6559.3
Qbt	Rhyolite tuff, yellowish-gray (5Y 8/1), pumice-rich, clayey ash matrix. +10F: 80–90% pumice fragments (up to 1.5 cm), earthy to vitric texture; no phenocrysts evident; 10–20% lithic fragments with 10–12% clay-cemented crystal and pumice-rich sandstone. +40F: 35% pumice; 25% phenocrysts; 40% lithic fragments.	135–145	6559.3–6549.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), pumice-rich, clayey ash matrix. +10F: 65–75% pumice fragments (up to 1.0 cm), white vitric luster, minor clay alteration; no phenocrysts evident; 25–35% lithic fragments (up to 0.7 cm), dacite prominent, rhyodacite common, minor basalt. +35F: 50–60% pumice; 20–25% phenocrysts; 15–20% lithic fragments.	145–160	6549.3–6534.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), pumice-rich, moderate clay in the ash matrix. +10F: 75% pumice fragments (up to 1.0 cm), fresh vitric luster, minor clay alteration; no phenocrysts evident; 25% lithic fragments, mostly subangular dacite, rare quartzite. +35F: 15% pumice; 25% phenocrysts; 60% lithic fragments.	160–165	6534.3–6529.3
Qct, Cerro Toledo Interval	Tephra/tuffaceous sediments, light olive-gray (5Y 6/1), lithic-rich, moderate clay in the ash matrix. +10F: 3–5% pumice; no phenocrysts evident; 95–97% volcanic lithic fragments, mixture of subangular to subrounded dacite and rhyodacite. Note: Qbt/Qct contact estimated at 166 ft bgs.	165–175	6529.3–6519.3
	Tephra/tuffaceous sediments, light brownish-gray (5YR 6/1), lithic-rich. +10F: 100% volcanic lithic fragments (clasts up to 1.5 cm), mixture of subangular to subrounded dacite, silicified dacite, and flow-banded rhyodacite. +35F: 10–20% pumice; 5–15% quartz and sanidine crystals; 75–85% volcanic lithic fragments. Note: Qct/ Qbo contact estimated at 183 ft bgs.	175–185	6519.3–6509.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Qbo, Otowi Member, Bandelier Tuff	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic-rich. +10F: 97% volcanic lithic fragments, gray and pink broken subangular to subrounded chips (up to 2.0 cm) of porphyritic dacite, flow-banded rhyodacite, and hornblende latite(?); 3–5% pumice with slight clay alteration. +35F: 10–15% pumice; 25–50% quartz and sanidine phenocrysts; 30–40% volcanic lithic fragments.	185–195	6509.3–6499.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic-rich. +10F: 99% volcanic lithic fragments, broken to subrounded gray dacite and white latite; 1–2% limonite stained pumice fragments. +35F: 10–20% pumice; 50–70% quartz and sanidine phenocrysts; 40–50% lithic fragments.	195–210	6499.3–6484.3
	Rhyolite tuff, varicolored, very light gray (N7) to light pinkish-gray (5YR 6/1), lithic-rich, pumiceous. +10F: 65–70% volcanic lithic fragments, broken to subrounded pink and gray dacite and white flow-banded rhyodacite (up to 1.0 cm); 30–35% pumice fragments (up to 1.5 cm), white to orange, vitric with weak clay alteration; +35F: 30% pumice; 25% quartz and sanidine phenocrysts; 45% lithic fragments.	210–215	6484.3–6479.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic- and pumice-rich. +10F: 60–70% volcanic lithic fragments (up to 0.7 cm, broken to subrounded, pink and gray dacite and whitish flow-banded rhyodacite; 30–40% pumice fragments (up to 1.0 cm), white to pale yellowish-brown, vitric with weak clay alteration +35F: 2–8% pumice; 60–70% quartz and sanidine phenocrysts; 15–45% lithic fragments.	215–230	6479.3–6464.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic-rich. +10F:100% volcanic lithic fragments (up to 0.7 cm), broken to subangular, mostly gray dacite with minor siliceous rhyodacite. +35F: 2% pumice; 78% quartz and sanidine phenocrysts; 20% lithic fragments.	230–235	6464.3–6459.3
Qbo	Rhyolite tuff, pinkish-gray (5YR 8/1), lithic-rich, pumiceous, pale tan clayey ash matrix. +10F: 70–90% volcanic lithic fragments (up to 0.8 cm), mostly pink and gray broken to subrounded dacite with minor silicic rhyodacite; 10-30% pumice fragments (up to 1.8 cm), white to orange, vitric, limonite-stained. +35F: 20–30% pumice; 40–60% quartz and sanidine phenocrysts; 20–30% lithic fragments.	235–245	6459.3–6449.3
	Rhyolite tuff, pinkish-gray (5YR 8/1), lithic-rich. +10F: 85–90% volcanic lithic fragments, mostly broken to subangular porphyritic dacite, locally bleached and/or altered; 7–15% pumice fragments, white, weak clay alteration. +35F: 20–25% white and yellow pumice; 50–60% quartz and sanidine phenocrysts; 15–20% lithic fragments.	245–255	6449.3–6439.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), lithic and pumice-rich, clayey ash matrix. +10F: 40–50% volcanic lithic fragments, mostly subangular gray and bleached and/or altered dacite (up to 1.0 cm), trace of gray quartzite; 40–50% pumice (up to 1.5 cm), white to pale orange, vitric, some limonite staining. +35F: 25% pumice; 35% quartz and sanidine phenocrysts; 40% lithic fragments.	255–260	6439.3–6434.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Qbo	Rhyolite tuff, yellowish-gray (5Y 8/1), pumice-rich. +10F: 75% pumice, white to pale orangish tan, vitric, some clay alteration (up to 1.5 cm). 25% volcanic lithic fragments, mostly gray to bleached dacite. +35F: 30% pumice; 30% quartz and sanidine phenocrysts; 35% lithic fragments.	260–265	6434.3–6429.3
	No cuttings returned in this interval.	265–275	6429.3–6419.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), lithic- and pumice-rich, some clay in ash matrix. +10F: 70–75% volcanic lithic fragments (up to 0.7 cm), mostly gray, pink, and white (bleached) dacite; 25–30% white pumice (up to 1.0 cm), unaltered to slight clay alteration. +35F: 40% pumice; 20% quartz and sanidine phenocrysts; 40% lithic fragments.	275–280	6419.3–6414.3
	Rhyolite tuff, varicolored, yellowish-gray (5Y 8/1) to medium gray (N5), lithic- and pumice-rich. Poor sample recovery. WR: 45–55% white pumice (up to 0.7 cm), unaltered to slight clay alteration; 40–50% volcanic lithic fragments (up to 0.7 cm), angular to subangular.	280–290	6414.3–6404.3
	Rhyolite tuff, varicolored, yellowish-gray (5Y 8/1) to medium gray (N5), lithic- and pumice-rich, clayey with clayey ash matrix and clay-coated chips. +10F: 40–60% white pumice, unaltered to clay altered and some pale orange limonite-stained pumices; 40–60% volcanic lithic fragments (up to 0.7 cm), gray to white (bleached) dacite. +35F: 25–35% pumice; 20–30% quartz and sanidine phenocrysts; 35–45% lithic fragments.	290–300	6404.3–6394.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic- and pumice-rich. Poor sample recovery. +10F: 65–70% volcanic lithic fragments dacite (up to 0.7 cm), angular to subangular gray and pink; 30–35% white pumice (up to 1.0 cm), vitric to clay altered.	300–305	6394.3–6389.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic- and pumice-rich, clayey ash matrix. +10F: 60–65% volcanic lithic fragments, gray and pink dacite; 35–40% white pumice (up to 1.0 cm), vitric to clay altered. +35F: 60% pumice; 15% quartz and sanidine phenocrysts; 25% lithic fragments.	305–310	6389.3–6384.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic- and pumice-rich, clayey ash matrix. +10F: 75% white pumice (up to 1.5 cm), clay altered; 25% volcanic lithic fragments, gray dacite and flow-banded rhyolite. +35F: 60% pumice; 15% quartz and sanidine phenocrysts; 25% lithic fragments.	310–315	6384.3–6379.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), lithic- and pumice-rich, clayey ash matrix. +10F: 50–60% white pumice (up to 1.5 cm) vitric to slight clay alteration; 40–50% volcanic lithic fragments, angular to subangular, light to dark gray dacite. +40F: 25–45% pumice; 30–50% quartz and sanidine phenocrysts; 30–40% lithic fragments.	315–330	6379.3–6364.3
	Rhyolite tuff, light brownish-gray (5YR 6/1), pumice-rich, clayey ash matrix. +10F: 85–90% white pumice (up to 1.5 cm), vitric to slight clay alteration; 10–15% dacite lithic fragments. +40F: 40–50% pumice; 15–20% quartz and sanidine phenocrysts; 35–45% lithic fragments.	330–335	6364.3–6359.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Qbo	Rhyolite tuff, grayish-orange pink (5YR 7/2), pumice- and lithic-rich, 25–30% clay in the matrix. +10F: 50–70% white pumice (up to 1.0 cm), vitric to some clay alteration; 30–50% light and dark gray angular to subangular dacite lithic fragments. +40F: 35–40% pumice; 30–35% quartz and sanidine phenocrysts; 25–30% lithic fragments.	335–345	6359.3–6349.3
	Rhyolite tuff, grayish-orange pink (5YR 7/2), pumice- and lithic-rich, 30–40% clay matrix. +10F: 40–60% white pumice (up to 0.5 cm), vitric to slight clay alteration. +40F: 40–45% pumice; 25–30% quartz and sanidine phenocrysts; 25–30% lithic fragments.	345–360	6349.3–6334.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), pumice- and lithic-rich, clayey matrix. +10F: 45–50% pumice (up to 0.5 cm), vitric to slight clay alteration; 5–10% quartz and sanidine phenocrysts; 40–45% volcanic lithic fragments, light and dark gray dacite, some hornblende latite. +35F: 50% pumice; 25% quartz and sanidine phenocrysts; 25% lithic fragments.	360–365	6334.3–6329.3
	Rhyolite tuff, yellowish-gray (5Y 8/1), 25–30% clay-rich matrix. +10F: 60–80% white pumice (up to 0.7 cm) vitric to moderate clay alteration; 20–40% volcanic lithic fragments, gray to pinkish dacite. +35F: 25–30% pumice; 40–50% quartz and sanidine phenocrysts; 20–25% lithic fragments. Note: Qbo/Qbog contact estimated at 374 ft bgs.	365–375	6329.3–6319.3
Qbog, Guaje Pumice Bed	Tephra deposit, yellowish-gray (5Y 8/1), pumice and lithic-rich, 25–30% clay-rich matrix. +10F: 55–65% white pumice (up to 1.0 cm), vitric to moderate clay alteration; 35–45% volcanic lithic fragments (up to 0.5 cm), pink and light gray dacite. +35F: 35% pumice; 40% quartz and sanidine crystals; 25% lithic fragments.	375–385	6319.3–6309.3
	Tephra deposit, yellowish gray (5Y 8/1), pumice and lithic-rich, 25–30% clay-rich matrix. +10F: 55–60% white pumice, (up to 1.0 cm), vitric to moderate argillic alteration; 40–45% volcanic lithic fragments (up to 0.5 cm), pink and gray dacite. +35F: 35% pumice; 30% quartz and sanidine crystals; 30% lithic fragments.	385–390	6309.3–6304.3
Tb4, Cerros del Rio basalt	Transitional Qbog/Tb 4 interval, light brownish-gray (5YR 6/1), mixed rhyolite and basalt chips, clayey matrix. +10F: 25–30% light pinkish tan very fine-grained indurated tuffaceous sandstone; 20–30% broken chips of black vesicular basalt vitrophyre with abundant limonitic clay rinds and coatings (palagonite?); 15–20% white pumice with slight clay alteration; 10–15% light gray subangular to subrounded dacite lithic fragments. Note: Qbog/Tb4 contact estimated at 392 ft bgs.	390–395	6304.3–6299.3
	Olivine basalt, medium dark gray (N4), porphyritic with microcrystalline groundmass, vesicular, light clay coating on chips. +10F: 3–5% brown olivine phenocrysts (up to 1.0 mm), oxidized and replaced by iddingsite; groundmass plagioclase slightly altered; tan clay coating on fractures and lining vesicles.	395–405	6299.3–6289.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tb4 Cerros del Rio Basalt	Olivine basalt, medium-dark gray (N4), slightly porphyritic with aphanitic groundmass, massive to slighty vesicular, clay coating on chips. +10F: 2–3% unaltered greenish olivine phenocrysts (up to 0.5 mm); groundmass partly altered.	405–415	6289.3–6279.3
	Olivine basalt, medium-dark gray (N4), slightly porphyritic with aphanitic groundmass, massive to slightly vesicular. +10F: 2% unaltered light green olivine phenocrysts (up to 0.5 mm); groundmass locally altered.	415–425	6279.3–6269.3
	Olivine basalt, medium-dark gray (N4), slightly porphyritic with aphanitic groundmass, massive to slightly vesicular. +10F: 2% olivine phenocrysts (up to 0.5 mm), oxidized to replaced; groundmass partly altered; fractures and vesicles thinly coated with iron oxide.	425–430	6269.3–6264.3
	Basalt / Scoria, dark gray (N3), aphanitic to very slightly porphyritic, aphanitic groundmass, very vesicular (scoriaceous). +10F: scoriaceous texture, most chips and fragments oxidized and/or coated with iron oxide.	430–440	6264.3–6254.3
	Olivine basalt, medium gray (N5), slightly porphyritic with aphanitic groundmass, massive to slightly vesicular. +10F: 1–2% olivine phenocrysts (up to 1.0 mm), opaque, replaced by iddingsite; groundmass strongly altered.	440–450	6254.3–6244.3
	Olivine basalt, medium gray (N5), porphyritic with aphanitic groundmass, vesicular. +10F: thin flat chips (up to 1.5 cm); 2–4% olivine phenocrysts (up to 2.0 mm), opaque, replaced by iddingsite; groundmass strongly altered throughout and bleached.	450–460	6244.3–6234.3
	Olivine basalt, light gray (N7), slightly porphyritic with aphanitic groundmass, massive, clay-sericite matrix binding chips together. +10F: 1–2% unaltered pale green olivine and dark opaque iddingsite-replaced olivine phenocrysts (up to 2.0 mm); groundmass strongly altered and bleached.	460–470	6234.3–6224.3
	Olivine basalt, light gray (N7), slightly porphyritic with aphanitic groundmass, massive, clay-sericite matrix binding chips together. +10F: 1–2% olivine phenocrysts (up to 2.0 mm), most are dark opaque and iddingsite-replaced; groundmass strongly altered throughout; 10–15% oxidized scoria from 475 to 480 ft bgs.	470–480	6224.3–6214.3
	Olivine basalt, medium gray (N5), porphyritic with aphanitic groundmass, massive to slightly vesicular. +10F: 2–3% olivine phenocrysts (up to 2.0 mm), partly to wholly replaced by iddingsite; groundmass moderately to strongly altered; 15–20% oxidized scoria from 485 to 490 ft bgs.	480–490	6214.3–6204.3
	No cuttings returned and no samples collected in this interval.	490–785	6204.3–5909.3
	Basalt, light gray (N7), aphyric, aphanitic, massive. +10F: 90–95% aphyric volcanic rock, feldspar-rich, altered and bleached; 5–10% white-cemented quartz sandstone. Note: this volcanic rock may be more siliceous than basalt.	785–790	5909.3–5904.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tb4 Cerros del Rio Basalt	Basalt, medium light gray (N6) to medium gray (N5), aphyric, aphanitic, massive. +10F: aphyric volcanic rock, abundant plagioclase laths, fine hornblende laths present, relict Fe-Mg minerals (up to 0.5mm) replaced by limonite, moderate to strongly altered, bleached appearance.	790–810	5904.3–5884.3
	No cuttings returned and no samples collected in this interval.	810–820	5884.3–5874.3
	Basalt, medium gray (N5), aphyric, aphanitic, massive. +10F: chips altered and bleached, trace of hornblende phenocrysts.	820–825	5874.3–5869.3
	No cuttings returned and no samples collected in this interval.	825–835	5869.3–5859.3
	Basalt/scoria, medium gray (N5), aphyric, aphanitic, massive to scoriaceous. +10F: chips slightly altered; groundmass contains felted plagioclase and trace of fine hornblende phenocrysts (up to 0.5 mm). +35F: 40–70% scoria fragments, white clay commonly filling vesicles. Vesicularity not observed in +10F.	835–845	5859.3–5849.3
	Basalt/scoria, medium gray (N5), aphyric, aphanitic, massive to scoriaceous. +10F: 90–95% massive, altered volcanic rock; 2–10% scoria. +35F: 50–60% massive volcanic rock; 40–50% black scoria cinders; 2–3% white clay.	845–860	5849.3–5834.3
	Basalt/scoria/sediments, medium gray (N5). +10F: 60–70% massive aphyric altered volcanic rock; 15–25% lithic fragments of dacite, pumice, and volcaniclastic sandstone, subangular to subrounded (up to 1.0 cm); 10–15% scoria. +35F: 55–65% scoria; 35–45% various volcanic rock fragments; 1-2% white clay.	860–870	5834.3–5824.3
	Basalt/scoria/sediments, medium gray (N5). +10F: 60–70% massive, aphyric altered volcanic rock; 15–25% lithic fragments of dacite, pumice, and volcaniclastic sandstone, subangular to subrounded (up to 1.0 cm); 10–15% scoria. +35F: 55–65% scoria; 35–45% various volcanic rock fragments ; 1-2% white clay.	870–880	5824.3–5814.3
	Basalt/scoria/sediments, medium dark gray (N4). +10F: 50–65% scoria, locally clay-coated and with amygdaloidal clay; 20–30% massive, altered basalt; 10–15% lithic fragments of dacite, subangular to subrounded; 1–2% white clay.	880–895	5814.3–5799.3
	Scoria/sediments, medium dark gray (N4). +10F: 55–65% scoria, locally clay coated; 30–35% lithic fragments of dacite and various volcanic rocks, subangular to subrounded (up to 0.7 cm); <5% massive basalt; 1–3% quartzite and granitic lithic fragments; 1–2% white clay.	895–910	5799.3–5784.3
	Scoria/sediments, medium dark gray (N4). +10F: 55–60% scoria; 35–40% lithic fragments of dacite and various volcanic rock; trace of quartzite.	910–915	5784.3–5779.3
	No sample recovery in this interval.	915–920	5779.3–5774.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tb4 Cerros del Rio Basalt	Scoria, dark gray (N3), WR F: 85–90% black and gray (altered and bleached) scoria; 10–15% dacite lithic fragments; minor amounts of pumice and white clay. +10F: 85–90% scoria; 10–15% dacite lithic fragments; trace of pumice.	920–925	5774.3–5769.3
	Scoria, dark gray (N3), WR F: 85–90% black and gray (altered and bleached) scoria; 10–15% dacite lithic fragments, pumice, and white clay. +10F: virtually no sample retained. Note: Tb4/Tpf contact estimated at 932 ft bgs.	925–935	5769.3–5759.3
Tpf, Puye Formation	Volcaniclastic sediments, medium-dark gray (N4). +10F: 50–60% dacitic clasts; 30–40% basalt fragments, massive and scoriaceous, locally subrounded clasts; 2–3% white cemented quartzose sandstone.	935–940	5759.3–5754.3
	Volcaniclastic sediments, medium-light gray (N6) gravel (GW), with clay, clasts broken to subrounded (up to 0.5 cm), 10–15% fines, clayey. +10F: 70-75% gray dacite, broken or subrounded; 25–30% clay-cemented sandstone. +35F: 90% volcanic clasts; 10% Precambrian lithic clasts.	940–945	5754.3–5749.3
	Volcaniclastic sediments, grayish and pink (5YR 7/2) gravel (GW) with clay +10F: broken fragments (up to 0.5 cm); 75–85% dacite fragments; 15–25% clay-cemented fine-grained sandstone, mixture of volcanic and quartz grains; 1–3% glassy scoriaceous basalt. +35F: 98% volcanic clasts, glassy beads of basalt common; 2% quartzite.	945–955	5749.3–5739.3
	Volcaniclastic sediments, grayish and pink (5YR 7/2) gravel (GW) with clay and sand. +10F: broken fragments (up to 0.5 cm); 70–85% volcanic lithic fragments, mostly dacite with some basalt; 15–30% clay-cemented fine-grained volcanic sandstone. +35F: 96–97% volcanic clasts, 2–3% quartz/quartzite.	955–965	5739.3–5729.3
	Volcaniclastic sediments, grayish and pink (5YR 7/2) clayey gravel (GC), 25-30% clayey fines. +10F: broken chips (up to 0.5 cm); 97% gray and pink dacite clasts; 2–3% massive and scoriaceous basalt clasts. +35F: 98% volcanic clasts, trace of glassy basalt; 2% quartzite.	965–970	5729.3–5724.3
	Volcaniclastic sediments, grayish and pink (5YR 7/2) gravel (GW) with sand, 10–15% fines. +10F: broken chips (up to 0.5 cm) 99% dacite clasts; 1% basalt clasts. +35F: 97% dacite grains; 1–2% quartzite; 1% basalt.	970–980	5724.3–5714.3
	Volcaniclastic sediments, varicolored, gray and pink (5YR 7/2) gravel (GW) with clay. +10F: 80–85% dacite clasts; 5–10% basalt clasts; 5–7% clay-cemented volcaniclastic sandstone, broken and subangular clasts. +35F: no sample retained.	980–985	5714.3–5709.3
	Volcaniclastic sediments, varicolored, pinkish-gray (5YR 8/1) clayey gravel (GC) with sand. +10F: broken and subangular clasts (up to 0.5 cm); 60–70% dacite clasts; 15–25% clay-cemented volcaniclastic sandstone, numerous clay-coated clasts; 10–15% basalt clasts, partly glassy. +35F: 65–75% volcanic lithic clasts; 25–35% sandstone lithic clasts.	985–995	5709.3–5699.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tpf, PuyeFormation	Volcaniclastic sediments, pinkish-gray (5YR 8/1) gravel (GW) with clay, clayey matrix, 10–15% fines. +10F: 60–70% broken and subrounded dacite clasts (up to 0.5 cm); 30–40% clay-cemented, fine-grained volcaniclastic sandstone clasts; trace of quartzite. +35F: 85–90% volcanic lithic clasts; 10-15% sandstone lithic clasts.	995–1005	5699.3–5689.3
	Volcaniclastic sediments, pinkish-gray (5YR 8/1) clayey gravel (GC) with sand, 20–30% fines. +10F: 60–70% broken and subangular dacite clasts (up to 0.3 cm); 25–35% clay-cemented, fine-grained volcaniclastic sandstone clasts; 1% basalt clasts; trace of quartzite. +35F: 85% volcanic lithic clasts; 10–15% sandstone lithic clasts.	1005–1015	5689.3–5679.3
	Volcaniclastic sediments, pinkish-gray (5YR 8/1) clayey gravel (GC) with sand, 20–30% fines. +10F: 80–90% broken and subangular dacite clasts (up to 0.3 cm); 10–20% clay-cemented, fine-grained volcaniclastic sandstone clasts; 1–2% quartzite, subrounded to rounded; <1% glassy basalt clasts. +35F: 99% dacite clasts; trace of glassy basalt clasts.	1015–1025	5679.3–5669.3
	Volcaniclastic sediments, pinkish-gray (5YR 8/1) gravel (GW) with clay and sand, 15–20% fines. +10F: 70–80% broken and subrounded dacite clasts (up to 1.3 cm); 20–30% clay and clay-cemented, fine-grained sandstone clasts; trace of quartzite. +35F: 99% dacite clasts; 1% quartz and sanidine grains.	1025–1035	5669.3–5659.3
	Volcaniclastic sediments, pinkish-gray (5YR 8/1) gravel (GW) with clay and sand, 15–20% fines. +10F: 75–80% broken dacite chips; 20–25% fragments of clay-cemented sandstone; <1% scoriaceous and glassy basalt. +35F: 99% dacite clasts; 1% quartz and sanidine grains; trace of basalt.	1035–1045	5659.3–5649.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) gravel (GW) with clay and sand, 15–20% fines. +10F: 80–90% broken to subangular light gray porphyritic dacite clasts; 10–20% clay-cemented, coarse-grained volcaniclastic sandstone; trace of basalt. +35F: 85–90% dacite clasts; 10-15% fine grained sandstone clasts; 1–2% quartz and sanidine grains; 1% glassy basalt clasts.	1045–1060	5649.3–5634.3
	Volcaniclastic sediments, pale yellowish-brown (10YR 6/2) gravel (GW) with silt and sand, WR: 60% gravel; 25% sand; 15% silt. +10F: mostly dacite clasts, some rounded (up to 7 mm); several clay-cemented, silty sandstone clasts; some rhyodacite clasts. +35F: mostly dacite clasts with some rhyodacite; 10% quartz grains.	1060–1070	5634.3–5624.3
	Volcaniclastic sediments, pale yellowish-brown (10YR 6/2) gravel (GW) with clay and sand, WR: 60% gravel; 25% sand; 15% fines, mostly clay. +10F: mostly dacite clasts, some subrounded (up to 1cm); some clay-cemented sandstone clasts; minor basalt and rhyodacite clasts. +35F: mostly dacite clasts; 5% quartz grains; 1–2% basalt clasts.	1070–1080	5624.3–5614.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tpf, PuyeFormation	Volcaniclastic sediments, pale orange (10YR 8/2) gravel (GW) with clay and sand, WR: 50% gravel; 30% sand; 20% fines, mostly clay. +10F: mostly dacite clasts; some clay-cemented, silty sandstone clasts; minor rhyodacite clasts. +35F: mostly dacite clasts; some mafic clasts (basalt); 5–10% quartz grains.	1080–1090	5614.3–5604.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) gravel (GW) with clay and sand, 10–15% fines. +10F: Chips broken to subangular; 90–95% gray and pinkish dacite clasts, locally silicified; 5–7% clay-cemented sandstone; 1–3% altered pumice; trace of quartzite. +35F: 90–95% dacite clasts; 5–10% sandstone; 1–2% vitric basalt clasts.	1090–1100	5604.3–5594.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) gravel (GW) with clay and sand, 10–15% fines. +10F: Chips broken to subangular (up to 4 mm); 80–85% pink and gray dacite clasts; 10–15% clay-cemented, fine-grained tuffaceous sandstone; 7–10% altered pumice. +35F: 85–90% dacite clasts; 5–7% altered pumice; 3–5% fine-grained tuffaceous sandstone; 1–2% basalt clasts.	1100–1110	5594.3–5584.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) gravel (GW) with clay and sand, 10–15% fines. +10F: Chips broken to subangular (up to 5 mm); 85–90% monolithologic gray dacite clasts; 10–15% clay-cemented sandstone. +35F: 85–90% dacite clasts; 10–15% sandstone; 1–2% quartz and feldspar grains; trace of basalt clasts.	1110–1120	5584.3–5574.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) gravel (GW) with clay and sand, WR: 30–40% gravel; 30–40% sand; 10–15% fines. +10F: 90–95% monolithologic gray to pinkish dacite clasts, mostly broken chips; 3–7% fine-grained sandstone; 1% altered pumice. +35F: 90% dacite clasts; 10–15% sandstone; 1–3% pumice. Note: pumiceous fanglomerate interval from 1127 to 1242 ft bgs.	1120–1130	5574.3–5564.3
Tpp, Pumiceous Puye Fanglomerate	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) clayey sand (SC) with gravel, WR: 10–20% gravel; 50–60% sand; 20–30% fines. +10F: chips broken to rounded; 50–60% pinkish dacite clasts; 10–15% basalt clasts; 7-10% altered pumice; 5–7% clay-cemented sandstone; 3–5% quartzite clasts, rounded, gray with white acicular crystals.	1130–1135	5564.3–5559.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) clayey sand (SC) with gravel, WR: 15–25% gravel; 40–50% sand; 15–25% fines. +10F: chips broken to subrounded (0.5–1.5cm); 85–90% pinkish and gray dacite clasts; 3–4% quartzite clasts; 2–3% basalt clasts; 1–2% altered pumice. +35F: 97% volcanic lithic fragments; 3% Precambrian lithic fragments.	1135–1140	5559.3–5554.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) clayey sand (SC) with gravel, WR: 10–15% gravel; 40–50% sand; 25–35% fines. +10F: chips broken to subrounded (up to 0.4cm); 50–60% pink and gray dacite clasts; 15–20% basalt clasts; 15–20% white altered pumice; 2–4% rounded quartzite grains.	1140–1150	5554.3–5544.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tpp, Pumiceous Puye Fanglomerate	Volcaniclastic sediments, very pale orange (10YR 8/2) clayey sand (SC), WR: 7–12% gravel; 40–50% sand; 25–35% fines. +10F: chips broken to rounded (0.3 to 2.0cm); 50–60% gray and pink dacite clasts with some latite; 10–20% basalt clasts; 10–15% white altered pumice; 3–4% white rounded quartzite grains.	1150–1160	5544.3–5534.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) clayey sand (SC), WR: 7–12% gravel; 40–50% sand; 25–35% fines. +10F: 25–50% white altered pumice; 20–25% dacite clasts; 10–20% basalt clasts; 1–4% white rounded quartzite grains.	1160–1170	5534.3–5524.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) clayey sand (SC), WR: 7–12% gravel; 40–50% sand; 25–35% fines. +10F: Chips broken to generally subangular (0.3 to 1.0 cm); 60–75% gray to pinkish dacite clasts, some latite, locally flow-banded; 5–7% basalt clasts; 2–3% white altered pumice; 2–3% rounded quartzite grains; 1–2% clay-cemented, fine-grained sandstone.	1170–1180	5524.3–5514.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) clayey sand (SC), WR: 10% gravel; 60–70% sand; 20–30% fines. +10F: Subangular to subrounded clasts (up to 0.4cm); 40–45% gray dacite clasts; 20–35% altered pumice; 10–15% subrounded to rounded quartzite clasts; 10–15% basalt clasts; 5–10% clay-cemented volcaniclastic sandstone.	1180–1190	5514.3–5504.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) clayey sand (SC), WR: 10% gravel; 60–70% sand; 20–30% fines. +10F: broken to subrounded clasts (up to 0.3cm); 40–50% gray dacite clasts; 15–20% clay-cemented fine-grained volcaniclastic sandstone; 10–15% white clay-altered pumice; 5–7% basalt clasts; 3–5% rounded quartzite clasts.	1190–1200	5504.3–5494.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) pumiceous clayey sand (SC), WR: 5–10% gravel; 60–70% sand; 25–35% fines. +10F: subangular to subrounded clasts (up to 0.3cm); 60–70% broken to subangular gray dacite chips; 25–30% white altered pumice; 7–10% basalt clasts; 1–3% quartzite grains.	1200–1205	5494.3–5489.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) pumiceous clayey sand (SC), WR: 5–10% gravel; 60–70% sand; 25–35% fines. +10F: Sub angular to surrounded casts; 50–70% white and oranges tan altered pumice; 30–40% decide casts with minor ethereal quartz crystal, trace of manganese oxide; 10–15% basalt casts; 1–2% rounded quartzite grains.	1205–1215	5489.3–5479.3
	Volcaniclastic sediments, very pale orange (10YR 8/2) pumiceous clayey sand (SC), WR: 5–10% gravel; 50–60% sand; 20–30% fines. +10F: 50-70% white altered pumice; 35–45% volcanic lithic fragments, mostly gray dacite clasts with some basalt; 2–3% fine-grained sandstone; 1–2% quartzite grains.	1215–1225	5479.3–5469.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tpp, Pumiceous Puye Fanglomerate	Volcaniclastic sediments, very pale orange (10YR 8/2) pumiceous clayey sand (SC), WR: 5–10% gravel; 50–60% sand; 20–30% fines. +10F: 70-75% white clay altered pumice; 20–25% gray dacite clasts; 2–3% basalt clasts; 1-2% rounded quartzite grains.	1225–1240	5469.3–5454.3
Tsf, Santa Fe Group Sediments	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) clayey sand (SC). +10F: broken to subangular clasts (up to 0.3 cm); 35–45% gray dacite clasts; 20–30% pinkish fine-grained tuffaceous sandstone; 15–25% white clay-altered pumice; 5–10% scoriaceous basalt clasts; only a trace of quartzite. Note: Tpp/Tsf contact estimated at 1242 ft bgs.	1240–1250	5454.3–5444.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: mostly broken chips (up to 0.3 cm); 80–90% gray dacite clasts, broken to subrounded (up to 0.3 cm); 3–5% basalt clasts; 3–5% rounded quartzite grains; 1–2% white pumice; 1–2% fine-grained sandstone.	1250–1255	5444.3–5439.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: mostly broken chips (up to 0.3 cm); 80–85% dark gray dacite clasts; 3-5% subrounded to rounded quartzite grains; 3–5% white altered pumice; 2-3% fine-grained sandstone; 2–3% scoriaceous basalt clasts.	1255–1265	5439.3–5429.3
	Volcaniclastic sediments, light brown (5YR 6/4) sand (SW) with clay and gravel. WR: 10–15% gravel; 60–70% sand; 10–15% fines. +10F: mostly broken chips (up to 0.3 cm); 70–75% gray dacite clasts; 7–12% pink siliceous porphyritic rhyodacite clasts with phenocrysts of biotite, hornblende, and quartz; 3–5% quartzite grains and few other granitic clasts; 2–3% pumice; 1-2% fine-grained sandstone. +35F: 10–15% quartzite.	1265–1275	5429.3–5419.3
	Volcaniclastic sediments, light brown (5YR 6/4) sand (SW) with clay and gravel. +10F: broken to subrounded chips (up to 0.3 cm); 80–85% pink to gray dacite clasts and some pinkish rhyodacite; 2–3% rounded quartzite grains; 2–3% white pumice; 2–3% fine-grained tuffaceous sandstone; 1–2% scoriaceous basalt.	1275–1290	5419.3–5404.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) clayey sand (SC) with gravel. +10F: 85–90% volcanic lithic fragments, mostly dacite with some rhyodacite and minor basalt; 2–3% fine-grained tuffaceous sandstone; 2–3% pumice; 2–3% rounded quartzite grains.	1290–1300	5404.3–5394.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: subangular to subrounded chips (up to 0.3 cm); 95–97% volcanic lithic fragments, mostly dacite with some rhyodacite and minor basalt; 2–3% quartzite grains; 1% pumice.	1300–1305	5394.3–5389.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: broken to subrounded chips (up to 0.3 cm); 90–95% volcanic lithic fragments, mostly gray dacite with some pinkish rhyodacite and a trace of basalt; 5–7% quartzite grains; trace of pumice.	1305–1315	5389.3–5379.3

Geologic Unit	Lithologic Description	Sample Interval (ft bgs)	Elevation Range (ft above msl)
Tsf Santa Fe Group Sediments	Volcaniclastic sediments, grayish-orange (10YR 7/4) sand (SW) with clay. +10F: 95–97% volcanic lithic fragments, mostly dacite with some rhyodacite and a trace of pumice and basalt; 1–3% quartzite grains.	1315–1325	5379.3–5369.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: 92–96% dacite clasts, broken to subrounded chips (up to 0.3 cm); 2-4% quartzite grains; 1% pumice; trace of basalt.	1325–1330	5369.3–5364.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: 85–90% pink and gray dacite clasts, subangular to subrounded chips (up to 0.3 cm); 10–15% subrounded to rounded quartzite grains; 1–2% pumice.	1330–1345	5364.3–5349.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: 90–95% pink and gray dacite clasts, mostly broken chips; 4–6% subrounded quartzite grains; 1–2% altered pumice; trace of basalt.	1345–1350	5349.3–5344.3
	No sample return in this interval.	1350–1355	5344.3–5339.3
	Volcaniclastic sediments, grayish-orange pink (5YR 7/2) sand (SW) with clay. +10F: 85–90% pink and gray dacite clasts; 10–12% rounded quartzite grains; 1–3% pumice; trace of basalt; trace of calcite.	1355–1365	5339.3–5329.3
	R-20 BOREHOLE COMPLETED AT 1365 FT BGS TOTAL DEPTH		

Notes:

1. American Society for Testing Materials (ASTM) standards (D 2488-90: Standard Practice and Identification of Soils [Visual-Manual Procedure]) were used to describe the texture of drill chip samples for sedimentary rocks such as alluvium and the Puye Formation. ASTM method D 2488-90 incorporates the Unified Soil Classification System (USCS) as a standard for field examination and description of soils. The following standard USCS symbols were used in the R-20 lithologic log:

   SW = Well-graded sand SM = Silty gravel CH = Clay, high plasticity
   GW = Well-graded gravel GM = Silty gravel SC = Clayey sand
   GP = Poorly graded gravel GC = Silt

2. Cuttings were collected at nominal 5-ft intervals and divided into three sample splits: (1) unsieved, or whole rock (WR) sample; (2) +10F sieved fraction (No. 10 sieve equivalent to 2.0 mm); and (3) +35F sieved fraction (No. 35 sieve equivalent to 0.50 mm).
3. The term *percent,* as used in the above descriptions, refers to percent by volume for a given sample component.
4. Color designations such as hue, value, and chroma (e.g., 5YR 5/2) are from the Geological Society of America's Rock Color Chart.

Appendix D

LANL Borehole Video Logs
(CD attached to inside back cover)

TO VIEW THE VIDEO THAT ACCOMPANIES THIS DOCUMENT, PLEASE CALL THE HAZARDOUS WASTE BUREAU AT 505-476-6000 TO MAKE AN APPOINTMENT

Appendix E

Schlumberger Geophysical Report/Montage
(CD attached to inside back cover)

GEOFRAME
PROCESSED
INTERPRETATION

Integrated Log Well Montage

Processed Wireline Geophysics Data

*A Mark of Schlumberger

Using the following logs: CMR*, ECS*, NGT*
TLD*, CNL*
FMI*, AIT*

COMPANY:	Washington Group / LANL		
WELL:	R-20		
FIELD:	Los Alamos Monitoring Well Network		
COUNTY:	Los Alamos		
STATE:	New Mexico		
COUNTRY:	U.S.		
Date Logged:	6-Sep-2002	Date Processed:	7-Feb-2003
Well Location:			
Elevations:	KB: 6699.00 ft	DF:	GL:
API Number:	Not Available	Job Number:	

FOLD HERE The well name, location, borehole reference data were furnished by the customer.

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

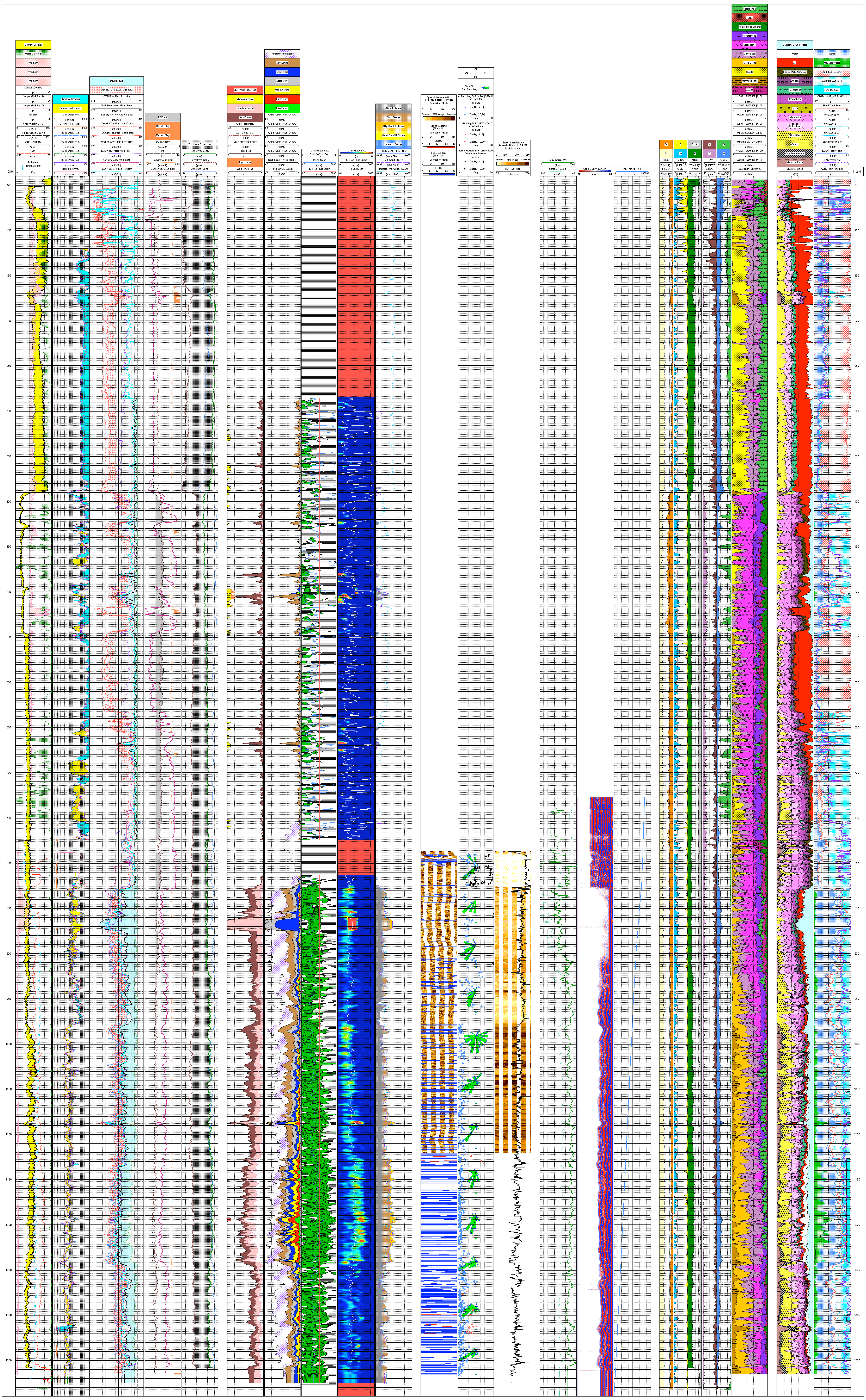
Field Recording:	Location:	Farmington	Software Version:	10C0-306	Engineer:	Meg Sobkowicz
Office Recording:	ICS Center:	SKS Sacramento	Baseline:	GF3.8.1	Log Analyst	Ned Clayton

Mud and Borehole Measurements:

Rm @ Measured temperature: 3.825 ohm.m @ 75.0 degF	BHT: 82.0 degF	Bitsize: 17.0 in
Rmf @ Measured temperature: 2.869 ohm.m @ 75.0 degF	Type Fluid in Hole	Foam (top), Gel Poly (bot.)
Rmc @ Measured temperature: 5.738 ohm.m @ 75.0 degF	Mud Density: 8.80 lbm/gal	

Remarks:

- Merged top and bottom open hole logging runs - acquired on different dates.
- AIT run used as primary depth reference.
- Run 2 (bot.) depth matched to first run (top).
- ELAN integrated log analysis performed with no porosity or water saturation constraints.
- Run 1 well water level was 756 ft. Run 2 level above top log interval.



Geophysical Logging Report

Schlumberger Water Services
June 2003

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1.0 ABSTRACT

This report describes the borehole geophysical logging measurements acquired in characterization well R-20 by Schlumberger, logged in August and September 2002 prior to well completion. It also presents the final processed results from these measurements and discusses the interpretation of these results. The logs were acquired in two runs at two separate times as the well was drilled in an effort to maximize the amount of open hole versus cased hole measurements. The August logging suite was acquired from 42 ft to 792 ft below ground surface, when the borehole was open (uncased) below 86 ft, drilled with 17 in diameter bit size, and contained approximately 18 in inner diameter steel casing above 86 ft (as measured by the logs). The September logging suite was acquired from 655 ft to 1378 ft below ground surface, when the borehole was open below 789 ft, drilled with 12.25 in diameter bit size, and contained 13.375 in outer diameter freestanding steel casing above 789 ft (as measured by the logs).

The primary purpose of the geophysical logging was to characterize the geologic/hydrogeologic section intersected by the well with emphasis on determining moisture content, perched groundwater zones, capacity for flow, and the stratigraphy/mineralogy of geologic units. A secondary purpose of the geophysical logging was to correlate seismic velocity versus depth for calibrating surface seismic surveys and to evaluate the borehole conditions such as borehole diameter versus depth, deviation versus depth, and degree of drilling fluid invasion. These objectives were accomplished by measuring, nearly continuously, along the length of the well: (1) total and effective water-filled porosity and pore size distribution, from which an estimate of hydraulic conductivity is made, (2) bulk density (sensitive to total water- plus air-filled porosity), (3) bulk electrical resistivity at multiple depths of investigation, (4) bulk concentrations of a number of important mineral-forming elements, (5) spectral natural gamma ray, including potassium, thorium, and uranium concentrations, (6) bedding orientation and geologic texture, (7) acoustic compressional wave velocity, (8) borehole inclination and azimuth, and (9) borehole diameter.

Preliminary results of these measurements were generated in the logging truck at the time the geophysical services were performed and are documented in field logs provided on-site. However, the measurements presented in the field results are not corrected for borehole casing and fluid conditions and are provided as separate, individual logs. The field results were reprocessed by Schlumberger to (1) correct/improve the measurements, as best as possible, for borehole/formation environmental conditions, (2) perform an integrated analysis of the log measurements so that they are all coherent, and (3) combine the logs in a single presentation, enabling integrated interpretation. The reprocessed log results provide better quantitative property estimates that are consistent for all applicable measurements, as well as estimates of properties that otherwise could not be reliably estimated from the single measurements alone (e.g. total porosity inclusive of all water and air present, water saturation, mineralogy).

The geophysical log measurements from Well R-20 provide good quality results that are consistent with each other through much of the borehole, although the quality of some measurements was degraded across a few intervals where the borehole contains large washouts. The measurements most affected by the adverse borehole conditions were ones that have a shallow depth of investigation and require close contact to the borehole wall—the bulk density, photoelectric effect, and the porosity measurements. The greatest impact on the log processing was erroneously high estimated air-filled porosity in the problem zones. While the quality of some of the water content measurements was degraded due to the borehole

conditions, generally at least one water content measurement was of good quality throughout. Through the integrated analysis and interpretation of all the logs, the individual shortcomings of the specific measurements are reduced. Thus, the integrated log analysis results (e.g. the optimized water-filled porosity log) are the most robust single representation of the geophysical log results—providing a wealth of valuable high resolution information on the geologic and hydrogeologic environment of the R-20 locale.

Important results from the processed geophysical logs in R-20 include the following.

1. A significant shift in water saturation (fraction of pore space occupied by water) at 755 ft—the location of the borehole fluid level at the time of the August logging. However, a large shift in the water content occurs at 827 ft—decreasing from 15–50% below to 5–15% above, with a corresponding equivalent decrease in total porosity associated with a significant lithology change. The low porosity formation above 827 ft has low hydraulic conductivity and, thus, is not an aquifer. These processed geophysical log results, interpreted by themselves, suggest that the top of the regional groundwater aquifer intersected by R-20 likely is 827 ft, with the tight bed above acting as a confining layer. It is possible the confining layer is saturated up to the depth of 755 ft.

2. The measured near wellbore water-filled porosity is greater than 20% of total formation volume through most of the interval 828–1365 ft, and is less than 20%, and predominantly below 10%, through most of the interval 46–828 ft. In the upper interval there are two major zones where the water content is elevated compared to surrounding zones: 132–286 ft and 398–546 ft, reaching 20% and 30% total rock volume fraction (matrix plus pore space), respectively. The highest water-filled porosities (greater than 30%) occur in the major zones 858–877 ft, 1086–1089 ft, and 1136–1244 ft.

3. Effective water-filled porosity (moveable water) is generally 5% or less through most of the logged section, ranging from a low of 0% to a high of 26%. Correspondingly, the estimated hydraulic conductivity is generally low. The highest effective water-filled porosities (greater than 10%) occur in the zones 1086–1090 ft and 1127–1240 ft, with a peak of 26% of total volume at 1194 ft.

4. The integrated log analysis shows a mafic-mineral rich and quartz/silica glass deficient interval from 393–924 ft, that likely corresponds to a basalt lava flow sequence. The interval 397–630 ft has very high matrix grain density (2.8-3.1 g/cc) and significant heavy mafic mineral content (10-22% dry weight fraction), but widely varying total (air and water-filled) porosity ranging from 11% to 55% volume fraction. The high porosity zones must be highly fractured and broken up (e.g. volcanic breccias), highly vesicular, or of “aa” texture. The remaining sections of the logged section contain a significant amount of quartz/silica glass.

5. A volcanic tuff sequence (likely the Bandelier Tuff) in the upper half of the logged interval (54–390 ft) is clearly distinguished by the logs and is characterized by

    - very high total porosity (60%) in the bottom 15 ft (275–390 ft), which likely corresponds to the Guaje Pumice Bed;
    - lower, but still high, porosity (50–55%) in the uphole direction from 172–275;
    - a distinct drop in the gross gamma log and bulk density across the zone 158–172 ft, for which the integrated log analysis shows decreased total porosity (average 35%) and increased amounts of clay, likely corresponding to a formation/lithology change;
    - very high total porosity (48–60%) across the interval 54–158 ft.

6. The integrated log analysis predicts significant, but highly variable, amounts of clay/montmorillonite below 975 ft, on average mostly above 10% dry rock matrix volume, frequently above 20%, and with a peak value of 62%. Above 975 ft there are a few zones with clay content above 20%, but most of the logged interval contains 15% or less, with many zones containing no clay.

7. Interpreted bed boundaries across the imaged interval 777–1370 ft have dip azimuths (direction beds are dipping to) predominantly in the sector 180–260 degrees, with the highest concentration falling in the 10 degree range 210–220 degrees. The mean dip azimuth across this interval is 226 degrees. The interpreted bed boundaries have a wide range of dip angles (degrees of dip) from zero to 60 degrees, although more than 90% have dip angles less than 20 degrees and the mean dip angle is 6 degrees. A number of fractures were discernable across this interval, having dip azimuths mostly in the sector 170–220 degrees and a mean dip azimuth of 192 degrees. The fracture dip angles ranged 20–90 degrees, with a mean of 47 degrees. Across much of the imaged interval (928–1370 ft) the electrical resistivity image shows a well-bedded, thinly-bedded alternating gravel-sand-silt-clay stratigraphy. Above this, the image exhibits much more massive bedding, likely corresponding to basalt lavas.

8. A significant portion of the borehole was washed out in the top half of the log interval (46–775 ft), the diameter ranging from 17 in (the bit size) to 25 in. The bottom half of the logged interval (775–1370 ft) contains only one interval of significant washouts (826–876 ft). Some of the washouts are abrupt, possibly cavities. The shallow-reading log measurements, predominantly the porosity reading ones, were adversely affected in a relatively few zones that contained abrupt washouts and/or high hole rugosity. The maximum deviation of the borehole across the log interval measured (777–1370 ft) is 3.5 degrees; the azimuth of deviation is to the north-northeast.

2.0 INTRODUCTION

Geophysical logging services were performed in characterization well R-20 by Schlumberger in August and September 2002, prior to initial well completion. The purpose of these services was to acquire in situ measurements that help characterize the borehole, near-borehole, and abutting geologic formation environment. The primary objective of the geophysical logging was to provide in situ evaluation of formation properties (hydrogeology and geology) intersected by the well. This information was (and is) used by scientists, engineers, and project managers in the Los Alamos Characterization and Monitoring Well Project to design the well completion, better understand subsurface site conditions, and assist in overall decision-making.

The primary geophysical logging services performed by Schlumberger in well R-20 were the

- Combinable Magnetic Resonance (CMR*) tool to measure the nuclear magnetic resonance response of the formation, which is used to evaluate total and effective water-filled porosity of the shallow formation and to estimate pore size distribution and in situ hydraulic conductivity;
- Compensated Neutron Tool (CNT*) to measure volumetric water content of the formation, which is used to evaluate moist/porous zones;
- Triple detector Litho-Density (TLD*) tool to measure formation bulk density, which is used to estimate total porosity;
- Array Induction Tool, version H, (AITH*) to measure formation electrical resistivity at five depths of investigation, which is used to evaluate drilling fluid invasion into the formation, presence of moist zones far from the borehole wall, and presence of clay-rich zones;
- Formation Micro-Imager (FMI*) tool to measure electrical conductivity images of the borehole wall in fluid-filled OH and borehole diameter with a two-axis caliper – used for evaluating geologic bedding and fracturing, including strike and dip of these features and fracture apertures, and rock texture;
- General Purpose Inclinometry Tool (GPIT*) to measure borehole deviation and azimuth in OH – used to evaluate borehole position versus depth and to orient FMI images;
- Natural Gamma Spectroscopy (NGS) tool to measure gross natural gamma and spectral natural gamma ray activity, including potassium, thorium, and uranium concentrations, which is used to evaluate geology/lithology, particularly the amount of clay and potassium-bearing minerals;
- Elemental Capture Spectroscopy (ECS*) tool to measure elemental weight percent concentrations of a number of elements – used to characterize mineralogy and lithology of the formation
- Digital Sonic Logging Tool (DSLT*) to measure acoustic compressional (P-wave) velocity – used to correlate seismic velocity versus depth for calibrating surface seismic surveys.

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In addition, calibrated gross gamma ray (GR) was recorded with every service except the NGS, for the purpose of depth matching the logging runs to each other. Table 2.1 summarizes the geophysical logging runs performed in R-20.

Table 2.1
Geophysical logging services, their combined tool runs and intervals logged, as performed by Schlumberger in borehole R-20

Date of Logging	Borehole Status	Run #	Tool 1	Tool 2	Tool 3	Depth Interval (ft)
26-Aug-2003	Open hole below 86 ft Bit size of 17 in. Steel casing above 86 ft. Casing ID of ~18 in.	1	NGS			43.5–792 ft
Same	Same	2	AITH	GR		120–798 ft
Same	Same	3	TLD	CNT	GR	60–793 ft
Same	Same	4	ECS	GR		42–788 ft
Same	Same	5	CMR	GR		286–781 ft
6-Sep-2003	Open hole below 789 ft Bit size of 12.25 in. Steel casing above 789 ft. Casing OD of 13.375 in.	6	TLD	CNT	GR	712–1366 ft
Same	Same	7	FMI	GPIT	GR	787–1370 ft
Same	Same	8	AITH	NGS		655–1366 ft
Same	Same	9	ECS	GR		735–1376 ft
Same	Same	10	DSLT	GR		736–1362 ft
7-Sep-2003	Same	5	CMR	GR		814–1366 ft

2.1 Technology Description

Geophysical logging represents mature, yet constantly evolving, technologies employed as the principal methods of borehole analysis in subsurface characterization. Geophysical logs have a long history of use in the groundwater industry for aquifer delineation and basic characterization. More recently, advanced logging technologies, developed for the petroleum industry, are being applied for characterizing a wide range of groundwater-related physical properties.

Wireline geophysical logging systems consist of three components (Figure 2.1):

1. downhole instrument (or sonde) introduced into a borehole that measures one or more physical properties of the formation (a logging “tool” is usually defined as the sonde plus required accompanying electronic cartridges;

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2. cable that connects the sonde to the surface, conducting power downhole and transmitting data uphole; and
3. logging truck that controls sonde location, provides power and houses a computer that controls sonde operation, as well as processes and displays data in real time. The resulting data are shown on a continuous strip chart commonly called a log.

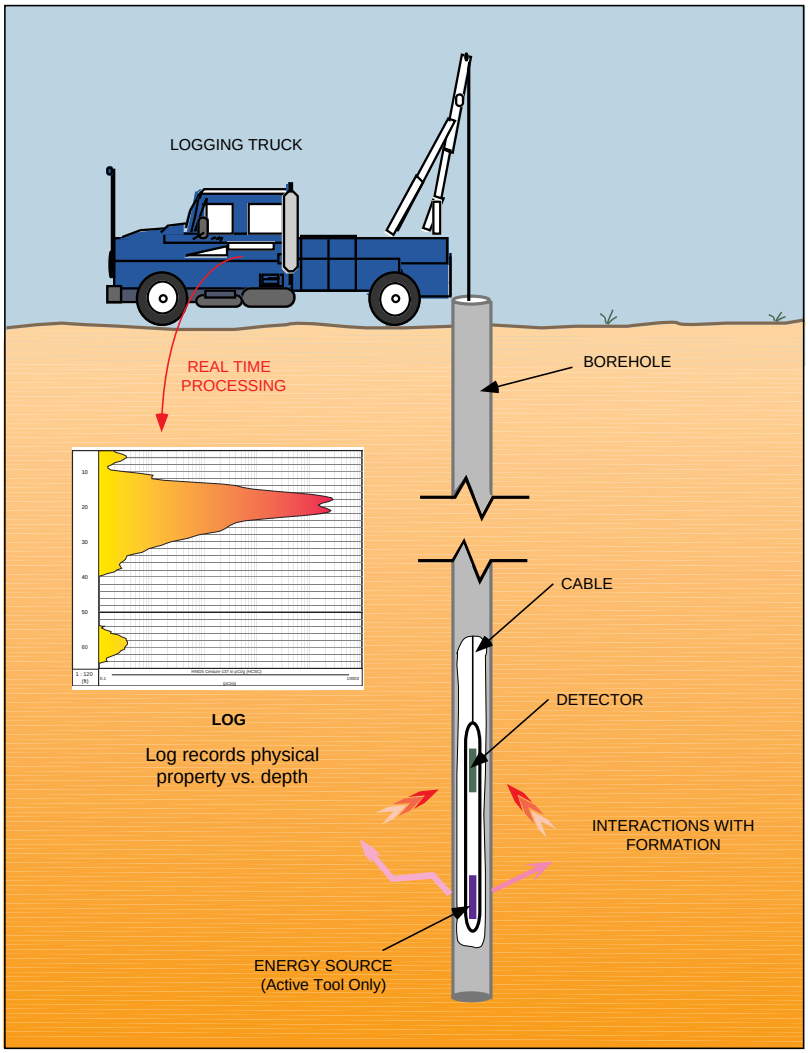

Figure 2.1: Schematic diagram of a wireline logging system in operation.

Geophysical logging systems are designed to give an accurate and precise in situ measurement of formation properties. Formation parameters commonly measured include porosity, moisture content, bulk geochemistry, hydraulic conductivity, orientation of bedding and fractures, identification and quantification of specific radionuclides and other elements, and many others. Similarly, logging systems provide accurate and precise measurements of completed well parameters, such as casing geometry, casing thickness, cement bond, and annular fill composition. Logging systems can also be used for downhole sampling and testing.

The integration of multiple logging technologies plus other data types (e.g., geologist's log, core analyses, surface geophysics, hydrologic test analyses) can lead to a fairly comprehensive picture of the

subsurface. The precision of the measurements, in concert with the potential to measure the same volume repeatedly (i.e., re-enter the same borehole), enhances the use of logging systems for monitoring.

2.1.1 Compensated Neutron Tool (CNT)

The CNT tool measures the hydrogen index (HI), which is usually closely related to hydrogen concentration and water volume and can be employed in either open or cased water-filled boreholes. The HI measurement is made by emitting high-energy neutrons from a 16-Ci Americium-Beryllium neutron source, which collide with atoms in the volume surrounding the tool and are slowed to epithermal and thermal energy levels. The number of slowed neutrons returning to a set of detectors is then measured. The CNT contains two He-3 thermal detectors, spaced 37.8 cm (15 in.) and 62 cm (24.7 in.) above the neutron source. This model of the CNT makes an HI measurement from thermal neutrons. The detectors count the neutrons that have been reduced to thermal energy level. Measured count rates from the detectors are used to compute a ratio that varies primarily with the hydrogen concentration, or HI, of the media, and is related to formation water-filled porosity. Environmental effects are reduced using the ratio of the two count rates from the two detectors, which are affected in a similar manner by the environment. Residual environmental effects can be corrected with offsite processing. While the HI measurement is calibrated to provide a volumetric water content estimate, it is affected by lithology; it measures all hydrogen in clays, including that in hydroxyl molecules, as well as other oddball neutron absorbers, typically resulting in an elevated porosity in clays.

The measurements are calibrated in open and cased boreholes, albeit the measurement will be affected by the annular fill between the casing and the formation. The median depth of investigation is approximately 7 in. and vertical resolution approximately 18 in., although the thermal measurement can be resolution-enhanced to 8 in.

Basic measurement specifications for the CNT are shown below.

Range of Measurement (water content):	0 to 60 %
Repeatability (Precision) (1 standard deviation or σ):	0– 20% = <1% porosity 20 to 30% = ± 2% porosity above 45% = ± 5% porosity

2.1.2 Combinable Magnetic Resonance (CMR)

The CMR makes pulse-echo nuclear magnetic resonance (NMR) measurements that are sensitive to the hydrogen nuclei (protons) contained in the pore space of the formation. These measurements contain information relating to both pore water volume and pore size. The pore size information can be used to partition the formation porosity into bound and free fluid volumes. This information can, in turn, be used to estimate formation hydraulic conductivity and water producibility. The pore size information also can be used to extrapolate relative grain size. The pore size information is unique to NMR logging devices.

The CMR log uses a compact magnet and antenna sensor package mounted in a pad-like skid that is pressed against the borehole wall. The tool has a vertical resolution of 6 in. (15 cm) and a median depth of investigation of 1.5 in. (4 cm). Since the CMR makes a shallow measurement that requires good borehole wall-to-pad contact, disruption of contact between the skid and the wall because of borehole washout or hole rugosity affects data quality, resulting in erroneously high/low total and free water content

in water/air-filled hole. The measurement also can be significantly affected by a sizeable presence of iron-bearing minerals, such as magnetite.

Basic measurement specifications for the CMR and a schematic diagram of the tool and sensor section are shown below and in Figure 2.2, respectively. The measurement specifications assume good logging conditions, good contact between the CMR pad and the borehole wall, and the absence of large amounts of magnetic material in the borehole environment.

Repeatability (σ):	Total water-filled porosity	1%
	Effective water-filled porosity:	0.5%
Total margin of error:	2%	

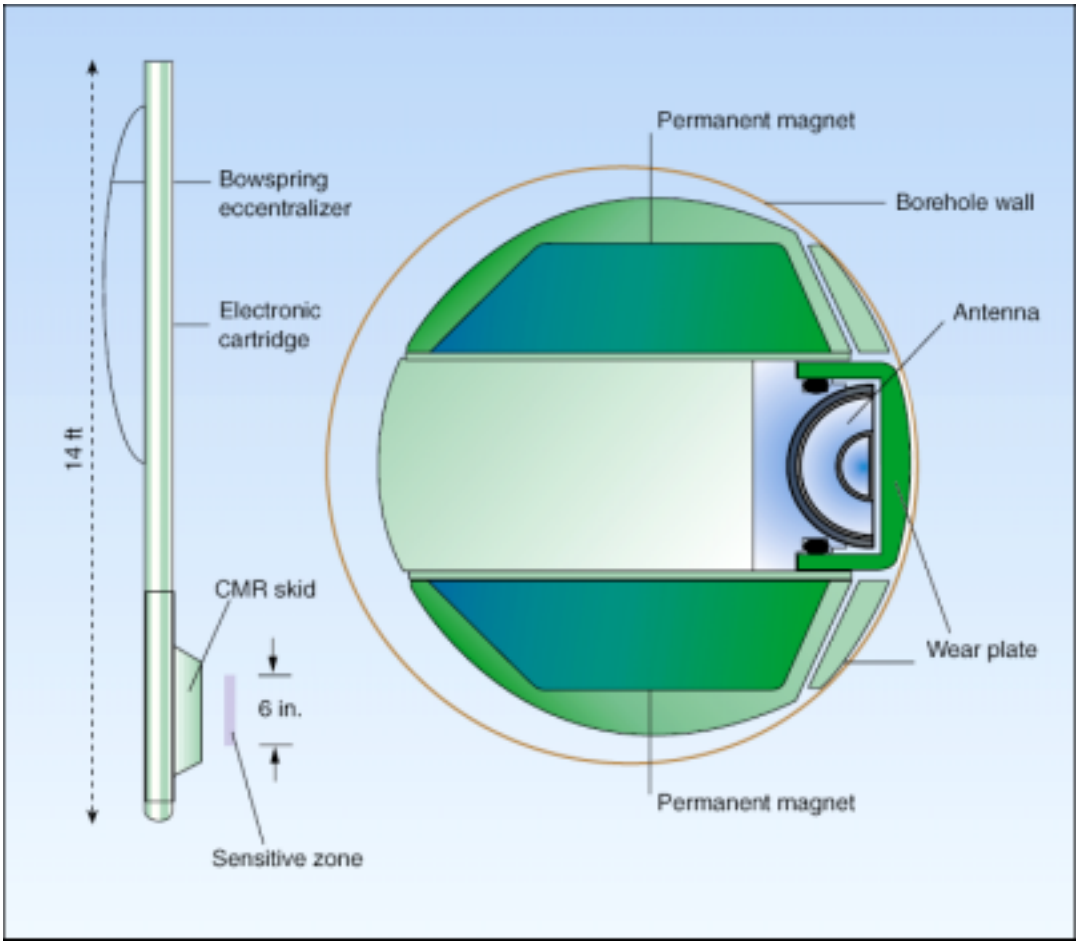

Figure 2.2. Schematic diagram of CMR tool with an enlarged cross-section of the sensor section

2.1.3 Triple Detector Litho-Density Tool (TLD)

The TLD tool is a triple-detector gamma-gamma (gamma ray source and gamma ray detectors) system for measuring compensated bulk density and formation photoelectric factor (P_e). Formation bulk density is a function of porosity, rock matrix density, and pore fluid density, and P_e is a measure of the average atomic number of the formation that corresponds to formation chemistry and lithology. The tool uses a focused gamma source (1.5-curie ^{137}Cs) to emit a large flux of gamma rays into the formation and

measures the resulting gamma intensity in dual near and far detectors. From these spectral measurements, a robust, environmentally corrected calculation of bulk density is made. True matrix porosity can be calculated based on bulk density, an estimation of matrix grain density (aided by the P_e measurement) and fluid densities. This porosity is unaffected by bound hydrogen in clays, as is porosity from neutron devices. The detectors, like the source, are highly focused because of their small size and heavy shielding and thus produce a high-resolution measurement.

The TLD also employs a third backscatter detector that improves the environmental correction for borehole washouts and rugosity, improves the dynamic range of the P_e, and has higher count rates and, thus, better measurement statistics, in hard rocks.

The TLD tool has a vertical resolution as high as 1.2 in. (3 cm) and a depth of investigation of 4 in. (10 cm). The tool is sensitive to changes in bulk density down to 0.01 g/cm3 and can be run in open hole and certain types of cased hole completions, and in both saturated and unsaturated formations.

The TLD uses a pad-like skid that is pressed against the borehole wall. Because the tool has a relatively shallow depth of investigation, it can be severely affected by borehole washouts and rugosity.

A schematic diagram of a TLD-type sensor system is shown in Figure 2.2.

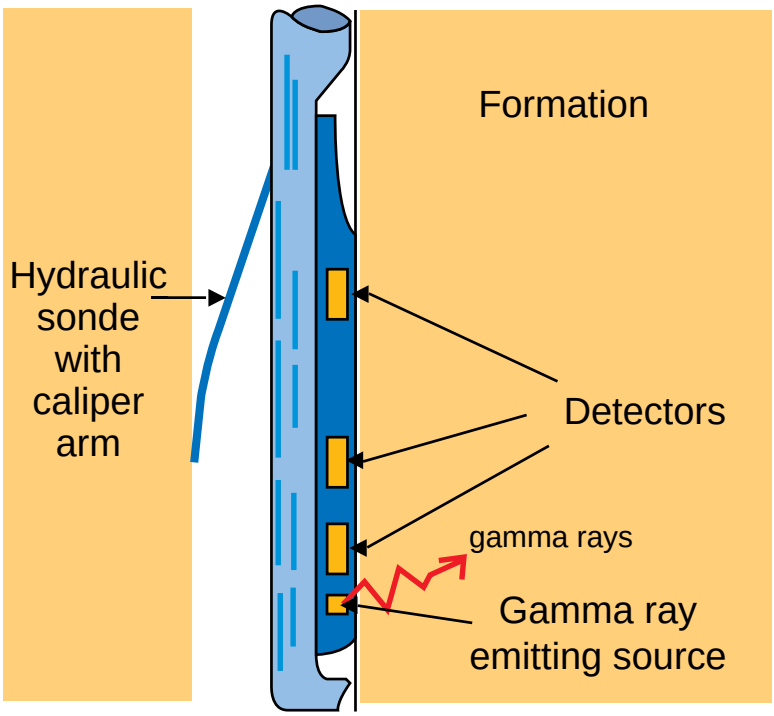

Figure 2.3. Schematic diagram of TLD-type density logging system.

2.1.4 Micro Cylindrically Focused Log (MCFL*)

With the Platform Express*, the MCFL measurements are integrated with the density sensors (TLD) in a single pad that presses against the formation. Consequently, the MCFL micro-resistivity measurement investigates the same volume of formation as the density measurement, with a vertical resolution of 2 in (5 cm). This high vertical resolution allows for enhanced thin bed analysis and fracture identification. The MCFL can be readily correlated and compared with the FMI* Formation Micro Imager high-resolution results. The MCFL measurements are based on three different depths of investigation, providing a highly focused micro-resistivity that is automatically corrected for standoff and mudcake during data acquisition.

The MCFL passes an electrical current into the borehole wall and, thus, requires water in the borehole and cannot be operated in cased hole. The MCFL uses a pad-like skid that is pressed against the borehole wall. Because the tool has a relatively shallow depth of investigation it can be severely affected by borehole washouts and rugosity.

Basic measurement specifications for the MCFL are shown below.

Range of measurement:	0.2–2000 Ohm.m
Repeatability (precision):	5% of measurement
Total measurement error:	20% from 0.2 to 2 Ohm.m
	5% from 0.2 to 200 Ohm.m
	20% from 200 to 2000 Ohm.m
Min/Max. hole size:	4.75 in./20 in.
Vertical Resolution:	2 in (5 cm); 8 in (20 cm) and 18 in (46 cm)
Depth of Investigation:	2 in. (5 cm.)

2.1.5 Natural Gamma Ray Spectroscopy (NGS) Tool

The NGS tool is a passive gamma ray measuring sonde that can be used in either open or cased boreholes. The tool measures the natural gamma activity energy spectrum with two sodium-iodide crystal detectors and uses a spectral weighted-least squares processing algorithm to resolve the three most common components of naturally occurring radiation—potassium, thorium, and uranium. The tool is designed for continuous logging and provides a depth/time averaged continuous log of the three elemental components in relative wt%. In addition, the standard gamma ray and gamma ray minus uranium are computed. The spectral gamma measurements are useful for evaluating clay content and clay type, especially when integrated with other types of log measurements.

Basic specifications for the NGS and a schematic diagram of the measurement sensor are shown below and in Figure 2.4, respectively.

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Range of measurement:	GR	0 to >750 API units;
	K	0 to ~50%;
	Th	0 to ~10,000 ppm;
	U	0 to ~10,000 ppm
Statistical precision (σ):	Th–1.5 ppm; U–0.9 ppm; K–0.25%	
Min./Max. hole size:	4.5 in. / 24 in.	
Depth of Investigation:	9.5 in (24 cm)	

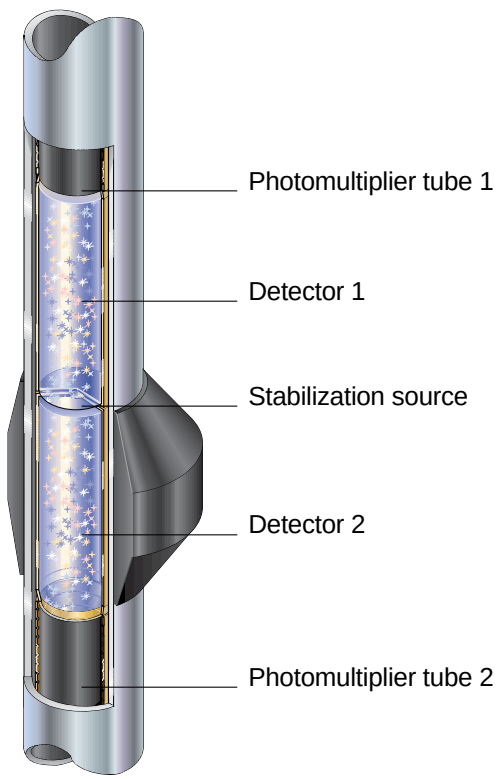

Figure 2.4. Schematic diagram of NGS sensor

2.1.6 Elemental Capture Spectrometer (ECS)

The ECS geophysical logging tool provides accurate measurements of the relative weight % concentrations of specific elements in the formation (such as Si, Ca, Fe, S, Ti, and Gd). The

measurements have sensitivities as low as 1% dry weight concentration or less (dependent on which element and the logging speed).

The ECS actively emits a large flux of neutrons into the region surrounding the probe using a 16-Ci Americium-Beryllium chemical neutron source. The neutrons collide and interact with atomic nuclei, prompting the release of gamma rays having characteristic energies, depending on the specific element and type of interaction. These induced gamma rays are measured by the tool's scintillation gamma ray detector, resulting in a total gamma energy spectrum measurement when the sum of gamma rays generated from all neutron-element interactions is considered. A weighted least squares algorithm is used to decompose the gamma ray contributions from specific elements based on a known detector spectral response, or standard, for each important constituent. The relative spectral contribution of the elements, or relative elemental yields, are converted to relative elemental dry weight % based on measurement characteristics of the tool type and an assumed mineralogical assemblage (oxide closure model).

The ECS employs a large shielded BGO spectral gamma ray detector that has very good measurement statistics. Because of the large detector, the ECS has a 5 in (127 mm) diameter.

The ECS works in either open or cased hole, and is relatively insensitive to borehole conditions, since the measurement is a dry matrix measurement (fluid contributions to the measurement are removed in the standard processing) and the radius of investigation is about 1 ft (30 cm). Thus, the ECS provides robust direct concentration measurements of important mineral-forming elements and provides robust mineralogical/lithologic control, very useful for developing a continuous mineralogy model along the borehole section when integrated with other wireline logs and core analysis results.

The statistical precision of the ECS measurement, for the standard suite of elements it measures, is shown in Table 2.2.

Table 2.2
ECS elemental weight % statistical precision at 100 ft/hr (30 m/hr) logging speed and 1.5 ft (0.46 m) depth average

Element	Weight % Precision (1 σ)
Si	0.63
Fe	0.07
S	0.27
Ca	0.57
Ti	0.03
Gd (ppm)	0.65
H	0.12

2.1.7 Array Induction Tool, Version H (AITH)

The AITH is a focused electrical induction probe that measures electrical conductivity/resistivity at multiple depths of investigation and vertical resolutions. The measurement is made by emitting an

electromagnetic field that induces a current in the formation, subsequently creating a secondary electromagnetic field that is measured by the tool. The tool measures R- and X-signals from eight arrays, six of which operate at two frequencies simultaneously. The surface acquisition unit processes these raw measurements into five resistivity logs in real-time, each with matched vertical resolution and with median depths of investigation ranging from 10 to 90 in (25–230 cm). These depths of investigation change minimally over the entire range of formation conductivities. Each set of five logs is available in vertical resolution widths of 4, 2, and 1 ft (120, 60 and 30.5 cm).

From these measurements the AITH provides quantitative estimates of the following.

- True bulk formation resistivity–Formation resistivity is a function of water content, water salinity, and clay content.
- Drilling fluid invasion–In instances where the borehole fluid and formation fluid possess contrasting conductivity values, the depth of invasion of filtrate can be mapped and the zones with higher permeability can be identified.

The results are also useful for stratigraphic correlation. Vertical resolutions down to 1 ft (30.5 cm) show laminations and other formation structures with minimal environmental effects.

Since a current is not directly emitted into the formation, the measurement does not require water in the borehole and is accurate in the sub-saturated zone above the water table.

The AITH is largely insensitive to borehole environmental conditions since it has a deep depth of investigation.

Basic measurement specifications for the AITH are shown below and a schematic diagram of the basic tool setup in Figure 2.5.

Range of measurement:	0.2–2000 Ohm.m
Total measurement error:	2% of measurement
Min/Max. hole size:	4.75 in./20 in.
Vertical Resolution:	1 ft (30.5 cm), 2 ft (61 cm), 4 ft (122 cm)
Depth of Investigation:	10, 20, 30, 60 and 90 in. (median response) (25, 51, 76, 153, and 229 cm)

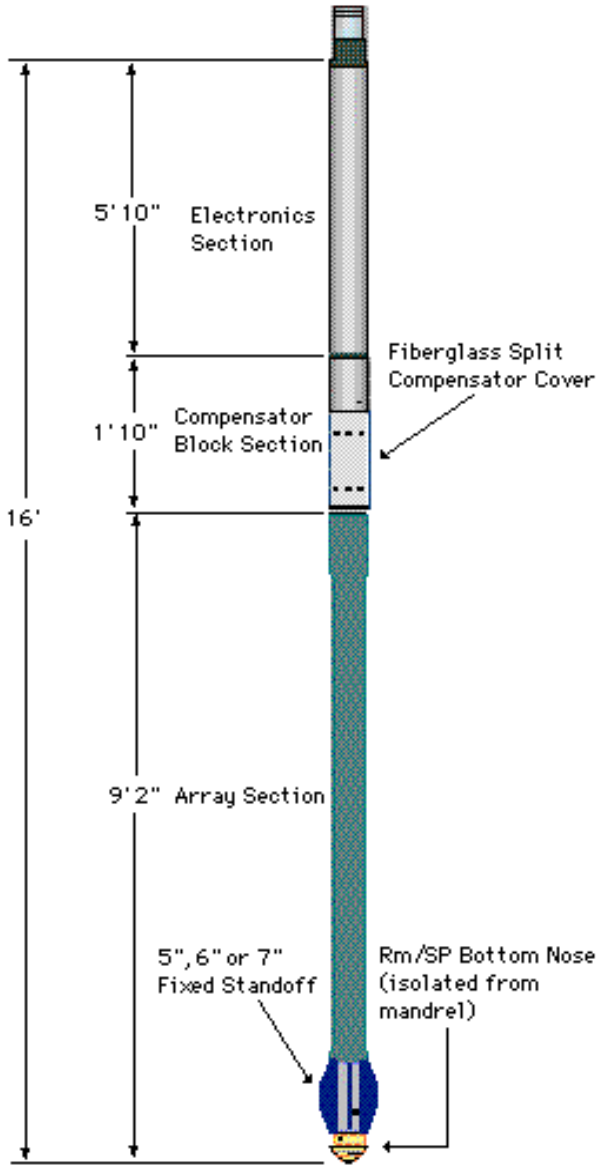

Figure 2.5. Schematic diagram of AIT tool, showing component lengths and standard logging setup.

2.1.8 Formation Micro Imager (FMI)

The FMI provides a high-resolution (≈ 0.2 in.) electrical image of the borehole wall using four pads with over 192 electrode buttons total. In addition the tool provides a two-axis caliper measurement. The position and orientation of the image is maintained through the utilization of down hole 3-axis inclinometer and 3-axis magnetometer; this information also provides a measurement of borehole deviation. These data permit the determination of orientation of any imaged borehole features. Features than can be identified and measured include:

- Bedding planes that permit the determination of structural strike and dip plus the orientation of stratigraphic features such as foresets

- Structural features such as faults, folds, or soft-sediment deformation
- Non-bedding features such as fractures, burrowing, vugs, pebbles, concretions, fissures, stylolites, etc. Fracture orientation and aperture can also be determined.

The FMI passes an electrical current into the formation and, thus, requires water in the borehole and cannot be operated in cased hole. However, unlike borehole video, borehole water opacity has no effect on the measurement. The measurement is best when the four pads are in physical contact with the borehole wall, but is still obtainable when the pad(s) lose contact. The tool general handles washouts quite well.

Basic measurement specifications for the FMI are shown below and a photo of the sensor section of the tool in Figure 2.6.

Statistical precision (σ):	Inclination – ±0.2°; Orientation – ±2°
Vertical Resolution:	<0.4 in (1 cm)
Min/Max. hole size:	6.25 in. / 21 in.

Figure 2.6. Photo of FMI sensor section, showing the four caliper arms, each containing a main pad and extender pad with electrode buttons (copper colored plates).

2.1.9 General Purpose Inclinometry Tool (GPIT)

The GPIT uses a three-axis magnetometer and a three-axis accelerometer to accurately define the tool system of axis with respect to the earth's gravity (G) and magnetic field norm (F). Since both vectors (G and F) are well defined within the earth's system, a relation can be established between the tool system and that of the earth. The logging truck computer system uses the three components of the magnetometer and accelerometer to calculate deviation, azimuth and relative bearing.

The GPIT is run as part of the FMI, but can be run by itself, as well, for open hole deviation surveys.

2.1.10 Digital Sonic Logging Tool (DSLT)

Sonic wireline logging tools are used to measure acoustic wave properties of the geologic formation intersected by a borehole. The main property measured by sonic tools is the acoustic wave velocity or slowness (also referred to as delta travel time or DT) versus depth. Most sonic tools, including the DSLT, measure sonic velocity / DT for the compressional / primary acoustic wave, but more advanced tools also measure the shear wave and sometimes Stoneley wave as well. The compressional wave velocity / DT helps in determining porosity, lithology, formation correlation, and formation mechanical properties. Compressional wave velocity / DT and transmitter to receiver transit times are also used in computing integrated transit time and generating synthetic seismograms, which help convert the time measurement made during surface seismic exploration to depth. Finally, in cased wells that are cemented in place, the amplitude of the first arrival is used in cement bond logging (CBL) to determine the quality of cement bond behind the casing.

The basic operation of the DSLT is as follows: A series of monopole transmitters in the DSLT (two in the typical tool setup) sequentially generate an acoustic wave that travels through the borehole fluid column (mud or water is required in the borehole), reaches the formation and travels through the formation. As the wave travels through the formation it generates waves in the borehole fluid. Therefore, for the borehole fluid, the wave traveling in the formation acts like a moving source. This source is moving at a velocity larger than the wave propagation velocity in the borehole fluid because the wave propagation velocity in the formation (a solid body) is larger than the wave propagation in the borehole fluid. As a result of this fast moving source, a head wave will be generated and will be detected by a series of sonic receivers (four in the typical tool setup) positioned a distance from the source.

The DSLT digitizes the recorded waveforms downhole and uses the Digital First Arrival Detection (DFAD) algorithm to measure the first arrival transit time (TT) and amplitude of the received signal. Older generation analog sonic tools use less reliable analog first arrival detection algorithms. In addition the DSLT can transmit the digitized waveform to surface using telemetry where the full waveform can be recreated and analyzed. Borehole compensated (BHC) compressional slowness (DT) is later computed from the measured transit times of the different DSLT transmitter-receiver couples.

3.0 METHODOLOGY

This section describes the methods employed by Schlumberger for performed geophysical logging services in Well R-20, including the following stages/tasks:

- Measurement acquisition at the well site
- Quality assessment of logs
- Reprocessing of field data

3.1 Acquisition procedure

Once the well drilling project team notified Schlumberger that each well was ready for geophysical well logging, the Schlumberger district in Farmington, NM, mobilized a wireline logging truck, the appropriate wireline logging tools and associated equipment, and crew to the job site. Upon arriving at the LANL site, the crew completed site entry paperwork and received site-specific safety training.

After arriving at the well site, the crew proceeded to rig up the wireline logging system, including

1. parking and stabilizing the logging truck in a position relative to the borehole that is best for performing the surveys;
2. performing any required environmental protection procedures (e.g., covering the ground with plastic liner, where the tools will be assembled, and around the well) as specified in the work order;
3. setting up a lower and an upper sheave wheel (the latter attached to, and hanging above, the borehole from the drilling rig/mast truck);
4. threading the wireline cable through the sheaves; and
5. attaching the appropriate sonde(s) for the first run to the end of the cable.

Next, pre-logging checks and any required calibrations were performed on the logging sondes and the tool string was lowered into the borehole. If any of the tools required active radioactive sources (in this case a neutron and gamma source for the CNT/ECS and TLD, respectively) just prior to lowering the tool string, the sources were taken out of their carrying shields and placed in the appropriate tool source-holding locations using special source handling tools. The tool string was lowered to the bottom of the borehole and brought up at the appropriate logging speed as measurements were made. At least two logging runs (one main and one repeat) were made with each tool string.

Upon reaching the surface any radioactive sources were removed from the tools and returned to their appropriate storage shields, thus eliminating any radiation hazards. The tool string was cleaned as it was pulled out of the hole.

The second tool string was attached to the cable for another suite of logging runs.

After completion of the surveys, any post-logging measurement checks were performed. Before departure, the engineer printed the field logs (including calibration summaries) for on site distribution and

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sent the data via satellite to the Schlumberger data archiving center in Sedalia, CO. The Schlumberger data processing center was alerted that the data were ready for initial post-acquisition processing.

3.2 Log Quality Control and Assessment

Schlumberger has a thorough set of procedures and protocols for ensuring that the geophysical logging measurements are of very high quality. This includes careful calibration of tools when they are first built, regular recalibrations and tool measurement/maintenance checks, and real-time monitoring of log quality as measurements are made. Indeed, one of the primary responsibilities of the logging engineer is to ensure, before and during acquisition, that the log measurements meet prescribed quality criteria.

CNT

The calibration and verification methodology for the CNT consists of an initial base calibration and verification, monthly shop verification, and a wellsite before and after verification. The initial base calibration constitutes the development of a measurement to moisture content algorithm for a certain set of environmental conditions. The calibration is based on Monte Carlo computer modeling and measurements in the Schlumberger EECF calibration models in Houston, TX. This initial base calibration only has to be performed once for a certain set of conditions.

Schlumberger also performs what is called a “master calibration,” which is actually a verification of water-filled borehole conditions where the CNT measurements are checked in a water tank with known saturated porosity. In addition, detector and neutron generator electronics are checked, and detector plateau voltages are set.

Detector electronics verifications are also performed before and after every logging run of the CNT, constituting the well site before and after verifications.

NGS

The Schlumberger calibration and verification methodology for the NGS, similar to the CNT, consists of an initial base calibration and verification, routine shop verification, and a wellsite before and after verification. The initial base calibration constitutes the development of measurement to gross gamma activity and spectral gamma activity algorithms, accounting for environmental conditions that influence the measurements. The initial base calibration only has to be performed once for a certain set of conditions.

The NGS gross gamma measurement in API units is made by taking a linear combination of U, Th, and K gamma activity yields to determine total count rates and then converting total count rates to API units. The coefficients of the linear combination and the API conversion are determined from the NGS response in the API test pits at the University of Houston (the API calibration standard) and calibration facilities at the Schlumberger Environmental Effects Calibration Facility (EECF) in Houston, which are tied to the API test pits.

In order to calibrate the spectral gamma activity measurements the response function of the NGS to each radioactive isotope of interest must be determined. The response function is the spectrum that would be observed by the tool for a given detector resolution and gain if just the one element were present and evenly distributed in the formation in a certain concentration. Such a spectrum is called a spectral standard. For natural gamma ray logging Th, U and K standards are used. Test formations with known concentrations of radionuclides at the API test pits and EECF are used to determine the NGS spectral standards.

The routine shop verification, referred to as a “master calibration” by Schlumberger, consists of measuring the NGS response to a thorium blanket with known Th activity and a background check. During the background check the detector response to an internal 22Na stabilization source is measured. In addition, detector electronics checks are performed. The primary task of the shop verification is to set the electronic gain ratios properly so that the Th and 22Na gamma peaks occur at the correct energy levels.

NGS response to the stabilization source and detector electronics verifications are also performed before and after every logging run of the NGS, constituting the wellsite before and after verifications.

ECS

The Schlumberger calibration and verification methodology for the ECS, similar to the NGS, consists of an initial base calibration and verification, routine shop verification, and a well site before and after verification. The initial base calibration constitutes the development of gamma ray energy elemental spectral standards for each of the elements the tool measures, accounting for environmental and tool design-specific conditions that influence the measurements. The initial base calibration only has to be performed once for all ECS tools produced to develop a tool response catalog for individual elements that the ECS is sensitive to.

The routine shop verification consists of taking measurements in a specially designed water tank to verify correct identification of the spectral hydrogen peak and performing detector electronic gain checks using the small cesium internal check source.

Well site before and after checks consist of background internal electronic checks.

TLD

Similar to the CNT and NGS, the calibration and verification methodology for the TLD consists of an initial base calibration and verification, monthly shop verification, and a well site before and after verification. The initial base calibration constitutes the development of a measurement to bulk density algorithm for a certain set of environmental conditions. The calibration is based on Monte Carlo computer modeling and measurements in the Schlumberger EECF calibration models. This initial base calibration only has to be performed once for a certain set of conditions.

The routine shop verification consists of checking the TLD bulk density measurement for uncased borehole conditions by making the measurement in materials with known densities. In addition, a background check with the gamma source removed from the tool is performed to verify that the system response to the 622 keV ^{137}Cs stabilization source located on each of the two detectors is accurate.

The background check is also performed before and after every logging run of the TLD, constituting the well site before and after verifications.

AITH

The Schlumberger calibration and verification methodology for the AITH consists of an initial base calibration and verification, routine shop verification, and a well site before and after electronics verification. The initial base calibration constitutes the determination of electronic gains and offsets and hardware adjustments for each individual tool so that the tool electrical induction response can be used to generate accurate electrical resistivity measurements. The initial base calibration has to be performed

only once for all AITH tools produced to develop a tool specific response catalog for electronic gains and offsets.

The routine shop verification consists of taking measurements with specially designed calibration sleeves to verify correct measurement response as well as internal electronic gain checks.

Well site before and after checks consist of internal electronic checks.

CMR

After an initial base calibration and intensive measurement and electronic system checks performed at the time of tool production, the CMR calibration and verification methodology consists of a routine shop (or master) calibration and well site before and after survey calibration/verification.

The shop calibration consists of a one-point calibration in which the signal amplitude at 100% water-filled porosity is found by placing a calibration jig filled with water in front of the tool sensor section. In addition, an electronic calibration of system gain is performed using an internal test loop located on the tool's antenna. The measured amplitude and electronic gain are saved as a lookup table in the internal memory of the individual CMR tool to be used when logging in the field for the calculation of CMR porosities.

The well site before survey calibration covers two procedures for tuning the sensor antenna to the magnetic resonance frequency of water (known as the Larmor Frequency), performed at the surface and downhole in the vicinity of the logging interval. This tuning procedure compensates the sensor response for the well specific effects of pressure, temperature, and metallic debris in the hole. In addition, a check of system noise is made.

At the completion of the CMR logging, one of the tuning procedures is repeated: the system search for the Larmor Frequency to verify that the log was run "in tune." This procedure constitutes the well site after survey verification.

3.3 Processing Procedure

After the geophysical logging job was completed in the field and the data archived, the data were downloaded to the Schlumberger processing center. There the data were processed, in the stated order to (1) correct the measurements for near-wellbore environmental conditions and redo the raw measurement field processing for certain tools using better processing algorithms, (2) depth match and merge the log curves from different logging runs, and (3) model the near-wellbore substrate lithology/mineralogy and pore fluids through integrated log analysis. Separately the FMI electrical image was processed to produce scaled and normalized high-resolution images that were interpreted to identify geologic features and compute fracture apertures. Afterwards an integrated log montage was built to combine and compile all the processed log results.

Environmental Corrections and Raw Measurement Reprocessing

If required, the field log measurements were processed to correct for conditions in the well, including fluid type (water or air), presence of steel casing, and (to a much lesser extent) pressure and temperature. Basically these environmental corrections entail subtracting from the measurement response the known influences of the set of prescribed borehole conditions. In R-20 the log measurements requiring these

corrections are the CNT porosity, TLD density, ECS elemental concentrations, and NGS spectral gamma ray logs.

The version of the CNT used in R-20 only measures thermal neutrons, not epithermal neutrons. To make neutron porosity measurements in air-filled hole measurement of epithermal neutrons is required. Thus, above 756 ft (water level in the well) the neutron porosity measurement is not valid. However, the thermal neutron porosity measurement was corrected for casing in the interval 775–820 ft (corresponding to the top of the September logging run).

The standard open hole processing algorithm used for the TLD density measurement is influenced by the steel density in cased hole. A cased hole density algorithm was applied to the raw TLD field measurements to try to eliminate the casing response. While the algorithm can account for the casing per say, it can not account for air- or water-filled gaps in the annulus between the casing and the formation—that cause erroneously low bulk density readings.

The raw ECS elemental yield measurements include the contribution of iron from steel casing and hydrogen from fluid in the borehole. The processing consists of subtracting these unwanted contributions from the raw normalized yields, then performing the normal elemental yields-to-weight fraction processing. The contribution to subtract is a constant baseline amount (or zoned constant values if there are bit/casing size changes), usually determined by comparing the normalized raw yields in zones directly below/above the borehole fluid/casing change. At the time of the first logging suite in R-20 there was no water in the borehole so no hydrogen correction was required. However, in the second logging suite the entire logging interval was below the well water level; in this case the hydrogen baseline subtraction was determined by a trial and error comparison of the resulting estimated ECS water content with CNT and TLD porosities to check relative agreement.

The iron baseline subtraction was determined by comparing the zoned after-subtraction processed iron weight fraction from above the bottom casing depth with the no-subtraction processed iron fraction below, adjusting the subtraction and reprocessing until a reasonable match is obtained. The validity of this procedure is dependent on the assumption that the formation iron content is constant directly above and below the bottom of the casing and that casing material is consistent throughout the cased section (e.g. there is not second string of casing behind the first further up the hole).

For the final processing performed at the time of the writing of this report, both the hydrogen and iron baseline subtractions of the September 2002 suite were optimized to match the August suite processed ECS results where the two runs overlapped. The primary consequence of uncertainty in these baseline subtractions is possible errors in the mineralogy result of the integrated log analysis, particularly in regards to the presence and amount of iron-bearing minerals, as well as in the total water content result (since ECS hydrogen weight fraction is used in the R-20 integrated log analysis).

The NGS spectral gamma ray are affected by the material (fluid, air, casing) in the borehole because different types and amounts of these materials have different gamma ray shielding properties; the NGS measures incoming gamma rays emitted by radioactive elements in the formation surrounding the borehole. The processing algorithms try to correct for the damping influence of the borehole material.

The measurements cannot be corrected for borehole washouts, rugosity, and the annulus material (if any) between casing and the formation since the specific characteristics of these features (e.g., geometry) are unknown and their effects on the measurements too complex to account for. Thus, the compromising effects of these conditions on the measurements should be accounted for in the interpretation of the log results.

Depth-Matching

Once the logs were environmentally corrected for the conditions in the wellbore and the raw measurement reprocessing was completed, the logs from different tool runs were depth-matched to each other using the AITH tool run as the base reference. Gamma ray was used as the common correlation log measurement for depth-matching the different runs. The second logging suite (September 2002) was depth-matched to the first suite (August 2002) by shifting the second suite AITH tool run to the first suite one (using gross gamma), then depth-matching the remaining tool runs in the second suite to the depth-shifted AITH run (using gross gamma).

Integrated Log Analysis

This analysis was performed using the Elemental Log Analysis (ELAN*) program. ELAN is a petrophysical interpretation program (Mayer and Sibbit, 1980; Quieren et al, 1986) designed for quantitative formation evaluation of cased and open-hole logs level by level. Evaluation is done by optimizing simultaneous equations described by one or more interpretation models.

The primary purpose of ELAN is solving the inverse problem in which log measurements, or tools, and response parameters are used together in response equations to compute volumetric results for formation components. This relationship is often presented in the triangular diagram below (Figure 3.1).

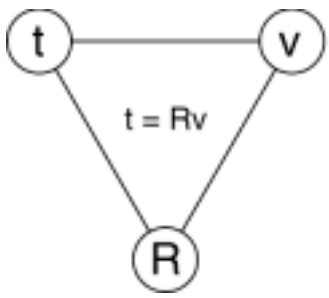


Figure 3.1. Schematic diagram of ELAN mathematical model

In this figure, t represents the tool vector—all logging instrument data and synthetic curves. The v is the volume vector, the volumes of formation components. R is the response matrix, containing the parameter values for what each tool would read, given 100% of each formation component. Given the data represented by any two corners of the triangle, ELAN can determine the third.

Additionally, ELAN includes methods by which individual models can be mixed and spliced to provide a combined model for more complex environments and large borehole extents. Each individual model is specified in a separate “Solve” process. The final result is produced by mixing and splicing the results from individual models in a “Combine” process.

The quality of the ELAN results can be assessed by reconstructing the individual geophysical logging curves from the solution and comparing them to the original data. However, a “good” fit does not

* Mark of Schlumberger

necessarily mean the correct ELAN, as the answer is non-unique. The degree of match between input and output curves is summarized as an error curve.

ELAN requires an a priori specification of the volume components present within the formation—fluids, minerals, and rocks. For each component, the relevant parameters for each tool are also required. For example, if one assumes that quartz is a volume component and the bulk density tool is used, then the bulk density parameter for this mineral is usually assumed to be 2.65 g/cc.

A key point in properly using ELAN is the input of the most representative parameter values possible. For certain minerals (e.g., quartz) most parameter values are fairly constant and easy to select; other mineral (e.g., clays) present the potential for wide variability in many parameters due to compaction (sonic slowness, bulk density) and minor changes in chemistry (Th, K, Fe, Al, H). Estimation of parameters, or their changes with depth, can be a major limitation to ELAN. Geochemical logs (acquired in R-20) are particularly helpful measurements for ELAN since they provide abundances of a number of important mineral forming elements.

ELAN simultaneously solves for multiple volume components using different tools. Some tools are highly influenced by parameters other than mineralogy and pore fluid (e.g., sonic), including geomechanical properties and borehole environmental conditions that cannot be corrected for in pre-processing. The dependency of the tool measurements on these conditions depends on the specific tool type and measurement. Including log measurements that are being highly influenced by these properties in the ELAN can significantly affect the solution, since variations in the logs are not only due to changes in mineralogy or pore fluid—what ELAN is trying to estimate. For example, if some of the logs are sensitive to washouts ELAN will try to match the log response in washed out zones by increasing the amount of porosity in the model, possibly at the expense of matching other log measurements used in the analysis that are not as sensitive to washouts (although the latter can be rectified by assigning more weight to the better logs). If some of the logs are affected by borehole conditions, or other properties not explicitly accounted for in the model (e.g. formation water salinity), while the others are not, often there is a poor match between modeled and actual log measurements in intervals where there are variations in these unaccounted for properties. Sometimes the solution can also become unstable—the model results change significantly due to only minor variations in log responses. In such cases it may be better to not include such measurements in the ELAN. In short, ELAN results are only as accurate at depicting true formation mineralogy and fluid content as the input logs are sensitive to the formation components included in the model—and insensitive to components/properties not included.

The tool measurements, volume components and parameters used in the ELAN analysis for R-20 are provided in Table 3.1. To make best use of all the measurement data and to perform the analysis across as much of the well interval as possible (44–1365 ft.), as many as possible of the processed logs were included in the analysis, with less weighting applied to less robust logs. Not all the tool measurements shown in these tables are used for the entire interval analyzed, as not all the measurements are available, or of good quality, across certain sections of the borehole. To accommodate fewer tool measurements certain model constituents are removed from the analysis in some intervals. Most notably, the distinction between free and bound water is removed above 286 ft, as well as the interval 774–813 ft, where there are no CMR measurement.

The ELAN analysis was performed with as few constraints or prior assumptions as possible. A considerable effort was made to choose a set of minerals or mineral types for the model that is representative of Los Alamos area's geology and it's volcanic origins. No prior assumption is made about water saturation—where the boundary between saturated (if any) and unsaturated zones lies (e.g. the depth to the top of the regional aquifer or perched zones). Thus, the presence and amount of air in the

pore space is unconstrained. Total porosity and water-filled porosity are also left unconstrained throughout the analysis interval. It was felt that the ELAN analysis should be performed with as few constraints as possible—even though the resulting model may show the effects of washouts and annular voids behind the casing (as elevated porosity) and drilling foam invasion (as elevated porosity and elevated/reduced water content, dependent on tool type)—in order to guard against presumptions that the results are conclusive when in fact they may not be. Thus, interpretations should be made from the ELAN results with the understanding that the mineral-fluid model represents a mathematically optimized solution that is not necessarily a physically accurate representation of the native geologic formation. Within this context, the ELAN model is a robust estimate of the bulk mineral-fluid composition that accounts for the combined response from all the geophysical measurements.

Table 3.1
Tool measurements, volumes, and respective parameters used in the R-20 ELAN analysis .

Volume / Tool Measurement	Air	Capillary Bound Water	Water	Hornblende	Hypersthene	Labradorite	Silica Glass	Heavy Mafic Minerals	Augite	Montmorillinite	Pyrite	Orthoclase	Quartz
Bulk density (g/cc)	–0.19	1.00	1.00	3.11	3.55	2.65	2.2	4.0	3.08	2.02	4.99	2.58	2.64
Thermal neutron porosity (ft^3/ ft^3)	–0.05	1.00	1.00	0.06	0.04	-0.01	0.0	0.07	0.02	0.65	0.01	-0.01	0.0
Volumetric photoelectric effect	0	0	0.40	12	20.2	7	4.2	65.00	23.8	4.4	82.1	7.3	4.8
Total CMR water-filled porosity (ft^3/ ft^3)	0	1.0	1.0	0	0	0	0	0	0	0.425	0	0	0
CMR free fluid volume (ft^3/ ft^3)	0	0	1.0	0	0	0	0	0	0	0	0	0	0
Resistivity (ohm-m)	Very high	20	20	Very high	Very high	Very high	Very high	Very high	Very high	1.04	Very high	Very high	Very high
Dry weight silicon (lbf / lbf)	0.0	0.0	0.0	0.21	0.24	0.24	0.47	0.18	0.23	0.26	0	0.3	0.47
Dry weight calcium (lbf / lbf)	0.0	0.0	0.0	0.09	0.0	0.09	0.0	0.0	0.10	0.01	0.0	0.0	0.0
Dry weight iron (lbf / lbf)	0.0	0.0	0.0	0.07	0.20	0.0	0.0	0.22	0.11	0.02	0.47	0.0	0.0
Dry weight sulfur (lbf / lbf)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.53	0.0	0.0
Dry weight titanium (lbf / lbf)	0.0	0.0	0.0	0.005	0.01	0.0	0.0	0.0	0.048	0.0	0.0	0.0	0.0
Wet weight potassium (lbf / lbf)	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.003	0.005	0.0	0.102	0.0
Weight water (lbf / lbf)	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.18	0.0	0.0	0.0
Wet weight thorium (ppm)	0.0	0.0	0.0	50	25	3	2	4	20	24	0	5.5	2
Clay bound water volume (ft^3/ ft^3)	0	0	0	0	0	0	0	0	0	0.425	0	0	0

4.0 RESULTS

This section describes the final log results from the borehole geophysical logging performed by Schlumberger in R-20. These results have been processed, if required, to correct for the well environment and depth-match the logs from different tool runs in the well. Also, some of the results are not directly measured logs but are instead logs generated from integrated analysis of measured logs. In the following description of the results, an attempt is made to organize the discussion based on the evaluation needs addressed by the logs instead of describing each log independently.

The log results are presented as continuous curves of the processed measurement versus depth and are displayed as (1) summary log displays for selected directly related sets of measurements and (2) an integrated log montage that contains all the final log curves, on depth and side by side. The summary log displays address specific characterization needs, such as moisture content. The purpose of the integrated log montage is to present, side by side, all the most salient reprocessed logs and log-derived models, depth-matched to each other, so that correlations and relationships between the logs can be identified.

First the R-20 final processed log results are presented as a number of useful summary logs and described according to specific evaluation needs addressed by the geophysical logs. Next, the integrated log montage is described track by track.

4.1 Water-Filled Porosity

One of the primary objectives of the geophysical logging was to evaluate volumetric water content (water-filled porosity) to identify wet and porous water-producing zones. The CNT neutron porosity, which measures water content in both open and cased hole below the borehole water level, was the primary service run for this purpose. The CMR was run to measure the water-filled pore size distribution and, most importantly, the amount of moveable water (effective water-filled porosity), which, in turn, provides valuable information on formation flow capacity (hydraulic conductivity). The TLD bulk density measurement provides useful information about total porosity—the sum of water-filled and air-filled porosity. The ECS geochemical measurement provides secondary information on water content through non-standard processing to obtain hydrogen weight fraction.

In the open hole sections of Well R-20 (comprising most of the two run merged log interval), below the well water level (756 ft) the CNT neutron porosity measures generally significantly higher than both the CMR water-filled porosity and ECS water content (estimated from hydrogen weight fraction). The ELAN integrated log analysis results show significant clay content in this interval, as does the CMR measure significant clay-bound water. It is likely that the presence of clay is causing the thermal neutron porosity to be elevated due to a lithology effect. Above the well water level the ECS estimated water content is generally significantly higher than the CMR total water-filled porosity, which is low. It is possible that the very shallow-reading CMR measurement is being affected by the desiccation of the near wellbore formation from invasion of drilling air/foam; conversely, it is possible the ECS measurement is affected by moist drilling foam filling the borehole (if present) that cannot be corrected for. While standing water in the borehole has a large affect on the CNT and ECS measurements, it is easily corrected for. The problem with the drilling foam is that it varies somewhere between air and water with regards to how the measurements respond and, thus, cannot be quantitatively corrected for. The CMR and TLD measurements are much less impacted by the foam filling the borehole because they are pad type tools

that are pushed against the formation; however, they are shallow reading measurements and could be affected by invasion of the foam—whether it acts to wet or dry the near wellbore formation.

To provide accurate quantitative measurements of total volumetric water fraction behind the casing, the CNT, TLD, and ECS hydrogen field measurements had to be corrected for borehole environmental conditions, primarily the casing and borehole fluid type. However, only a short section of the combined two logging runs were in casing (775–789 ft). The CNT neutron porosity field measurements did not require any additional environmental corrections beyond those applied at the time of the measurement. The field measurements from all three of these tools required reprocessing for casing and, for the ECS, water within the borehole. The measurements cannot be corrected for the effects of enlarged casing-to-formation annulus, borehole washouts, and rugosity (causing an increased borehole fluid response), since the specific characteristics of the annular voids and washouts (e.g., geometry) are unknown and their effects on the measurements too complex to account for. Thus, it should be understood that the porosity measurements are highly influenced by borehole diameter variations, especially when there are large washouts behind the casing that are filled with drilling mud or water. However, this does not appear to be a problem in the short cased hole log interval in R-20.

The best estimate of true water content is obtained from the ELAN integrated log analysis, since none of these measurements actually directly measures volumetric water content. This analysis accounts for the individual measurement response to each matrix and pore volume constituent, as well as the relative uncertainty in the measurements, in solving for a single matrix-pore volume model at each depth that best accounts for the processed measurements results.

The ELAN water-filled porosity results for R-20 are shown as part of the summary logs in Figure 4.1 (solid dark blue curve and blue shading in the second track from the right), and in expanded form, as part of the integrated log montages provided in Appendix E of the LANL R-20 Well Characterization Report (compressed form shown in Figure 4.7). The summary log also displays:

- ELAN total (water- and air-filled) porosity (red hashed curve in track furthest to the right);
- Air-filled porosity (dotted red shading in track furthest to the right);
- ELAN water saturation (dotted light blue curve in track furthest to the right);
- Gross gamma ray (solid brown curve in first track from left);
- Apparent bulk chlorinity estimate from the ECS (dashed green curve and green shading in first track from left) and
- Caliper with measured washouts (dashed black curve with washouts shown by pink shading).

At the time of the August 2002 geophysical logging the only water in the borehole was possibly at the bottom (below 755 ft), as indicated by the thermal neutron porosity measurement becoming negligible in air-filled hole in which the measurement cannot be made, although the fluid was likely a mixture of drilling foam and water. At the time of the September 2002 logging the borehole water level was above the top of the porosity logs (712 ft) and, thus, could not be determined; the entire log interval was in water-filled hole. There is significant uncertainty in defining where true 100% saturation of the virgin geologic formation occurs from the geophysical logs (corresponding to conditions within the regional aquifer or in perched zones above, where the entire pore space is filled with water)— due to the unknown effects of the drilling fluid and introduced water on the formation directly adjacent to the borehole and, ultimately, on the log measurements. In addition, the borehole has some significant washouts and hole rugosity, which can adversely affect the log measurements by elevating their response to the fluid/air filling the washouts. Even without such borehole conditions, the water saturation estimate from the geophysical logs is very sensitive to the matrix grain density.

Despite these measurement and water saturation processing difficulties, the ELAN integrated log analysis results do indicate a significant shift in water saturation (fraction of pore space occupied by water) at 755 ft—the location of the borehole fluid level at the time of the August logging (see Figure 4.1). However, a large shift in the water content occurs at 827 ft—decreasing from 15–50% below to 5–15% above, with a corresponding equivalent decrease in total porosity associated with a significant lithology change. It is possible the processed logs indicate high water saturation across the interval 755–827 ft due to the invasion of borehole water into the low porosity formation—contaminating the log response. In any case, the low porosity formation above 827 ft has low hydraulic conductivity (indicated by the log derived estimate displayed in Figure 4.1, right most track) and, thus, is not an aquifer. These processed geophysical log results, interpreted by themselves, suggest that the top of the regional groundwater aquifer intersected by R-20 likely is 827 ft, with the tight bed above acting as a confining layer. It is possible the confining layer is saturated up to the depth of 755 ft, or 755 ft is the potentiometric head of the regional aquifer (the static water level in the well).

There are a few zones above 755 ft where the processed log results sporadically peak at or near 100% water saturation: 54–82 ft, 107 ft, 114–115 ft, 479–482 ft, 581 ft. These increases in water saturation are largely the result of decreased total porosity and relatively constant water content across the zones—corresponding to a net decrease in air content and, thus, more of the pore space being occupied by water. However, none of these zones clearly exhibit perched water, especially considering the uncertainty in the total and water-filled porosity estimates from the logs and the fact that most of the zones are characterized by anomalous peaks in water saturation. The thicker upper zone is within the surface casing and could be the result of moisture- and clay-rich grout behind the casing.

Other significant features of the R-20 porosity summary log are as follows:

- Zones with apparent water content of 30% or greater by volume:
  - 54–83 ft (this is within the surface casing and likely a measurement of annular fill material, not formation conditions)
  - 107–108 ft
  - 114–116 ft
  - 505–506 ft
  - 833–836 ft
  - 850–856 ft
  - 858–877 ft
  - 884–886 ft
  - 983–987 ft
  - 1023–1024 ft
  - 1079–1081 ft
  - 1086–1089 ft
  - most of 1136–1244 ft
- Very high total porosity (40–56%) and low water content (5%) in the zones 543–633 ft, 641–644 ft, and 648–653 ft. These zones do not contain significant washouts and the density correction is within limits, suggesting the porosity estimate is accurate. The high P_e measurement and ELAN integrated log analysis mineral content results, containing heavy

mafic minerals, suggests the rock is likely basaltic in composition. Thus, the zone probably is comprised of a severely broken-up lava flow (possibly an “aa” basalt?) or volcanic breccia.

- Similarly high total porosity in the zones 424–438 ft and 526–536 ft, but these zones contain significant washouts and the density correction is flagged, indicating the high porosity could be the result of measuring air-filled washout and not true formation porosity.
- Very high total porosity (45–60%) at the top of the log interval (54–390 ft), likely due to a combination of the existence of high porosity tuffs and/or pumice beds. Based on the spectral gamma ray and geochemical logs, and the ELAN analysis, a tuff/pumice sequence comprises the interval above 390 ft. The total porosity in this interval has the following trends (progressing in the upwards direction from 390 ft):
    - Two peaks at the bottom reaching 58% from 274–390 ft, likely corresponding with the Guaje Pumice Bed
    - a marked decrease in porosity (28–40%) in the interval 158–172 ft, likely corresponding to a formation/lithology change
    - extremely high porosity (60–85%) at the very top of the log interval (44–86 ft), which lies within the surface casing and is likely elevated by the effect of annular fill on the density measurement.
- The highest measured effective porosity, or moveable water content, (greater than 10%) and, thus, estimated hydraulic conductivity, occurs in the intervals 1086–1090 ft and 1127–1240 ft, with a peak of 26% of total volume at 1194 ft. All indications are that these measurements represent true formation conditions, as there are no significant washouts that would affect the CMR tool across these intervals. In the remainder of the logged interval effective porosity or moveable water content is generally 5% or less.

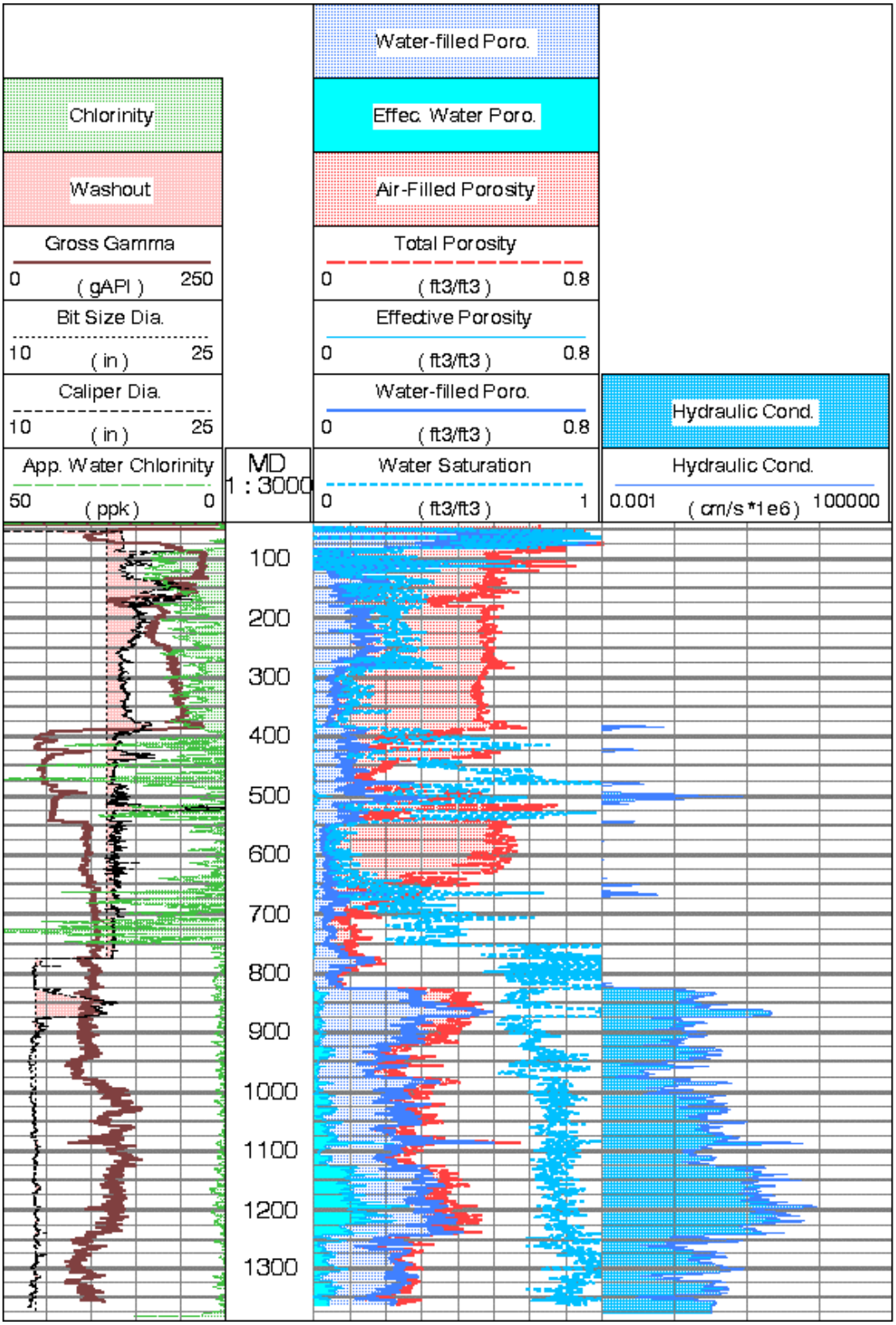


Figure 4.1. Summary porosity logs in R-20 borehole from processed geophysical logs, interval 50–1365 ft, with caliper, gross gamma, apparent chlorinity, and water saturation logs. Porosity and water saturation logs are derived from the ELAN integrated log analysis.

4.2 Density

Bulk density and P_e log measurements, obtained from the TLD geophysical tool in R-20, provide information about the formation total porosity (water and air) and lithology, respectively. The TLD measurements are typically only valid in open borehole, but there is a cased hole bulk density algorithm that has been adapted and implemented at Los Alamos. This algorithm was only required in R-20 at the top of logged interval in the surface casing (44–86 ft) and in a short interval (775–789 ft) where there was free-standing casing in the hole at the time of the second logging run. There is no way to rectify the P_e measurement in casing; thus, P_e could not be utilized in the above-mentioned zones. The bulk density is the only measurement in the suite of logs run in R-20 (and most geophysical log measurements) that is directly sensitive to all formation components: air-filled porosity, water-filled porosity, and rock matrix. Total air plus water-filled porosity in the vadose zone can be estimated from density porosity when it is computed in conjunction with a water content measurement (e.g., neutron porosity or ECS hydrogen weight fraction) and an independent measurement/assumption of grain density. The processed bulk density curve, as well as the apparent grain density derived from the ELAN analysis, is displayed as part of the summary logs (third track from left) for R-20 in Figure 4.2. Another applicable curve in this summary log is gross gamma ray (for stratigraphic correlation), shown in the farthest left track.

The bulk density and P_e measurements have a shallow depth of investigation and, thus, the measurements can be severely affected by borehole washouts and standoff from the formation (i.e. when measuring through casing where there is an annulus between the casing and formation)—measuring the density and P_e of water/air instead of the formation. The TLD has a strong caliper arm to push the sensor pad against the borehole wall, but, with casing in the well, the pad can only be pushed as far as the inner wall of the casing and, thus, cannot compensate for any annulus between the casing and formation. The bulk density measurement is made using three detectors; the tool tries to compensate for differences in the near and far detector response by performing an internal processing correction, which is shown on logs as a density correction curve, flagged when it goes above/below quality cutoff thresholds. This flag is used as an indication when the TLD measurement quality may be compromised. However, the density correction cannot be computed for cased hole.

Total porosity was computed from the ELAN integrated analysis of all the log measurements, including bulk density as a crucial input, as displayed in the first track from the right on the summary log (Figure 4.2) and the second track from the right on the integrated log montage (inclusive of the depth track). In this analysis no constraints were placed on air or water-filled porosity through the entire depth section. As can be seen on the summary logs, the ELAN total porosity mimics bulk density since bulk density is the primary measurement providing information on air-filled porosity. Overall, the total porosity appears to be valid throughout much of the depth section. Suspect zones, due to large washouts, where indicated in the previous section on water-filled porosity (4.1).

The P_e measurement is a good indicator of lithologic changes. In this geologic setting, an increase in P_e above 3 is a good indicator of the presence of heavy, probably mafic, minerals; an increase to 5 is an indicator of a very heavy mineral-rich bed (“heavy” most likely corresponding to iron content), such as a massive basalt lava flow. P_e is consistently above 3 from 392–924 ft and mostly above 4 (often 5 or above) from 400–830 ft. The optimized ELAN mineral model results (see the integrated log montage, fourth track from the right) indicate that most of this section contains at least small amounts of heavy, iron-rich mafic minerals (such as magnetite and olivine), with significantly higher concentrations in the upper interval of 397–630 ft (10-22% dry weight fraction, matrix grain density of 2.8-3.1 g/cc) and overall lower concentrations in the lower interval of 630–924 ft (0-10% dry weight fraction, matrix grain density of

2.6–2.8 g/cc). The dense upper section is probably basalt lava flow material. The lower interval is also likely comprised of basaltic rock, although with a lower heavy mafic mineral content. The intervals of the logged section where P_e less than 3 generally contain a significant amount of quartz/silica glass, as estimated from the ELAN results. In contrast, where P_e is greater 3 the ELAN mineralogy indicates little or no quartz/silica glass.

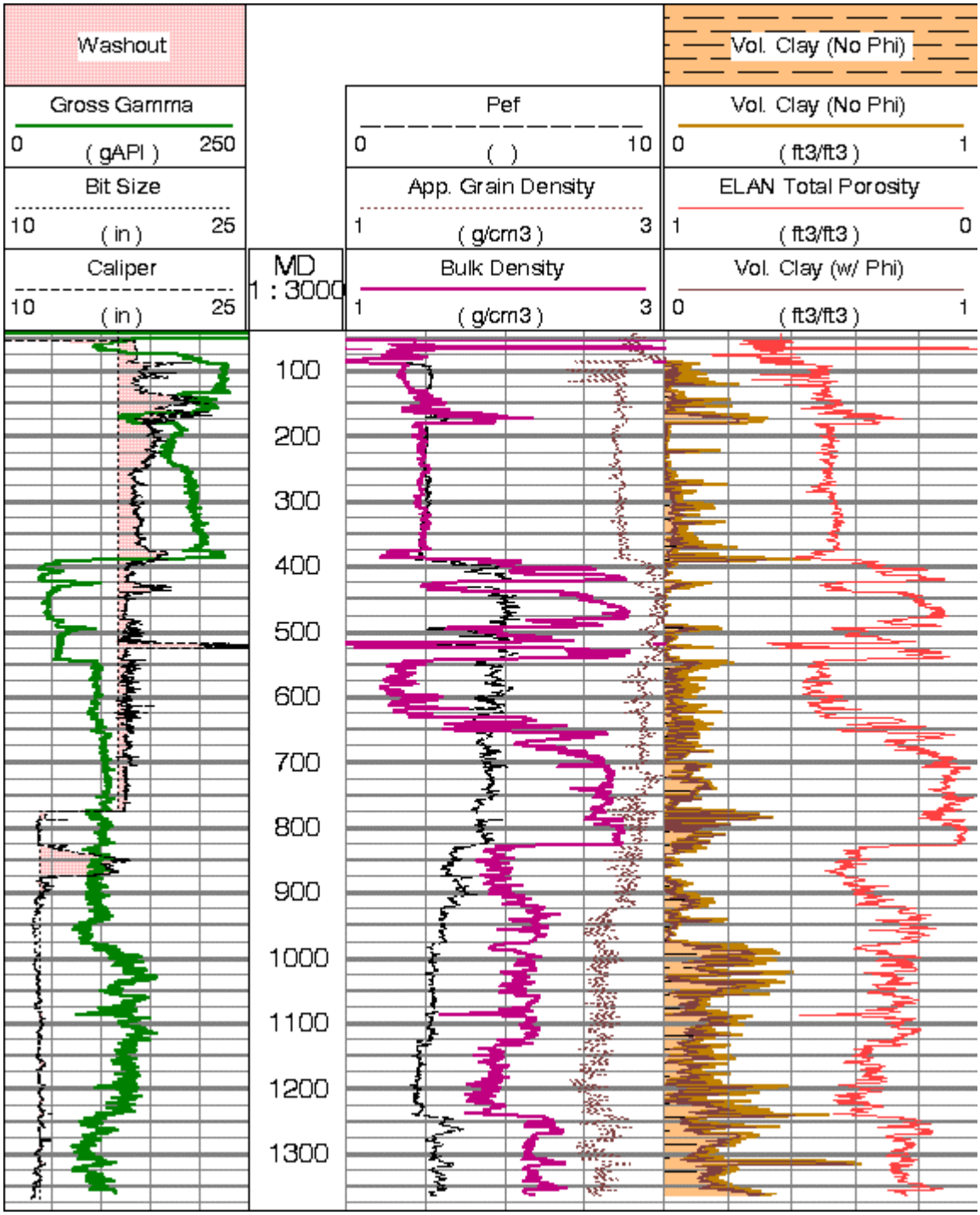


Figure 4.2. Summary bulk density and volume clay logs in R-20 borehole from processed geophysical logs, interval 50–1365 ft. Also shown– caliper, gross gamma, apparent grain density, and total porosity logs.

4.3 Volume of Clay

Volume of clay is of interest particularly because clay can have a large influence on hydraulic conductivity as well as the groundwater geochemistry. Unfortunately, there is no way to directly measure volume of clay from geophysical logging. It can only be derived indirectly from other log measurements, preferably a combination of measurements. Of the logging services run in R-20, the one that provides the most information about clay content is the NGS spectral gamma ray, since thorium and potassium are often associated with clays. However, because of the complex geologic history of the Los Alamos area, including many periods of volcanic activity, the geologic section contains numerous minerals other than clays that produce similar spectral gamma (and gross gamma) responses. This fact greatly complicates the estimate of clay volume directly from gamma ray measurements. The ECS provides important information about the collection of all minerals present since it measures the concentration of a number of important mineral-forming elements. Unfortunately, it cannot directly measure aluminum—the most important clay-forming element—although an indirect geochemical-derived estimate of aluminum can be made that is valid in siliciclastic rocks. The P_e measurement from the TLD provides additional information about bulk mineralogy, since it is sensitive to changes in the atomic number of mineral-forming elements, but it doesn't provide any specific information about clay minerals. The AIT resistivity measurement is sensitive to clay since clay has a low bulk resistivity; however, the measurement is also sensitive to pore water salinity and porosity. In addition, the CMR measures clay-bound water, which can be considered an indirect indicator of clay.

Considering the above-mentioned circumstances, the most robust way to estimate clay volume from the geophysical logs is to use all the logs together to solve for the full mineral and fluid volumetric composition of the formation. This type of analysis constitutes an inverse problem and can be performed using the ELAN program. Clay volume, along with the remaining matrix and fluid volumes, was estimated using the ELAN integrated log analysis approach with a fairly comprehensive mineral/fluid model containing montmorillonite, silica glass/quartz, orthoclase (representative of alkali feldspars), labradorite (representative of plagioclase feldspars), hypersthene, hornblende, augite, an analog representative of heavy mafic minerals (such as magnetite and olivine), water, and air. This set of volume constituents was chosen to provide a representative cross-section of possible major minerals in the R-20 geologic environment.

The ELAN volume model result, as well as the dry wt% model result, is also shown as part of the integrated log montage, provided in Appendix E of the LANL R-20 Well Completion Report (and in Figure 4.4 in compressed form). The volume of clay derived from these ELAN results for R-20, presented both as (1) fraction of the total (matrix plus pore space) volume and (2) fraction of just the matrix volume (pore space subtracted out), are shown as part of the summary logs (farthest track to the right) in Figure 4.2.

The ELAN analysis predicts variable amounts of clay/montmorillonite throughout most of the logged section. The analysis results indicated significant, but variable, amounts of clay/montmorillonite below 975 ft, on average mostly above 10% dry rock matrix volume and often above 20%. The highest clay amounts occur in the zones 1240–1245 ft (maximum 52% of dry rock matrix volume) and 1312–1328 ft (maximum 62%). Above 975 ft there are a few zones with clay content above 20%, but most of the logged interval contains 15% or less, with many zones containing no clay.

4.4 Spectral Natural Gamma Ray

Natural gamma ray spectroscopy logs were acquired in R-20 for the purpose of

- identifying geologic/lithologic layer boundaries,

- correlating geologic/lithologic units with other wells, and
- helping in the evaluation of mineralogy, including clay content.

The processed spectral gamma log results are shown as summary logs in Figure 4.3 and in expanded form as part of the integrated log montage in Appendix E or the LANL R-20 Well Completion Report (shown compressed in Figure 4.4). On the summary log, gross gamma and gross gamma minus the uranium contribution are displayed in the first track (from left), useful radioisotope ratios are displayed in the third track, and the individual radioisotope concentrations–potassium (K), thorium (Th), and uranium (U)–are displayed in the fourth track.

The NGS spectral gamma measurements are of good quality throughout the log interval, valid for the purpose of interpretation. The raw field measurements were preprocessed to correct for borehole environmental conditions–mainly the change from water in the bottom section of the hole to air and the presence of steel casing in a few sections of the combined run logged interval. There is some uncertainty in the casing correction, particularly the precise amount of amplification to apply to the recorded gamma ray signal in order to account for the suppressing effect of the thick steel casing. Also the unknown size and presence of material (e.g. bentonite drilling mud) in the annulus cannot be corrected for; thus the processed measurements include any gamma ray contribution/suppression from annular material. Most of the combined run logged interval in R-20 was open hole and the K and Th spectral components were used as valuable input to the ELAN analysis. If possible, it is not recommended to use U as an input to the ELAN model, because it can vary significantly for a particular mineral component due to independent processes (e.g. water flow, geochemical conditions); U was not used in the R-20 ELAN.

The R-20 spectral gamma ray logs have a number of distinct characteristics, which are described below:

- Overall across the logged interval Th and U trend together, resulting in relatively constant baseline ratio of these measured elements, but K does not trend with Th or U.
- The interval from the top of the logged interval (46 ft) to 390 ft contains the highest Th, K, and U in the logged interval – peaking at 24 ppm, 4.5% wet weight, and 11 ppm, respectively. This interval corresponds to the presence of volcanic tuff or pumice deposits, based on very similar spectral gamma response in other wells.
- Throughout the logged interval all the spectral gamma ray logs contain a lot of character and variability that is reflective of both major and subtle formation and lithology changes.

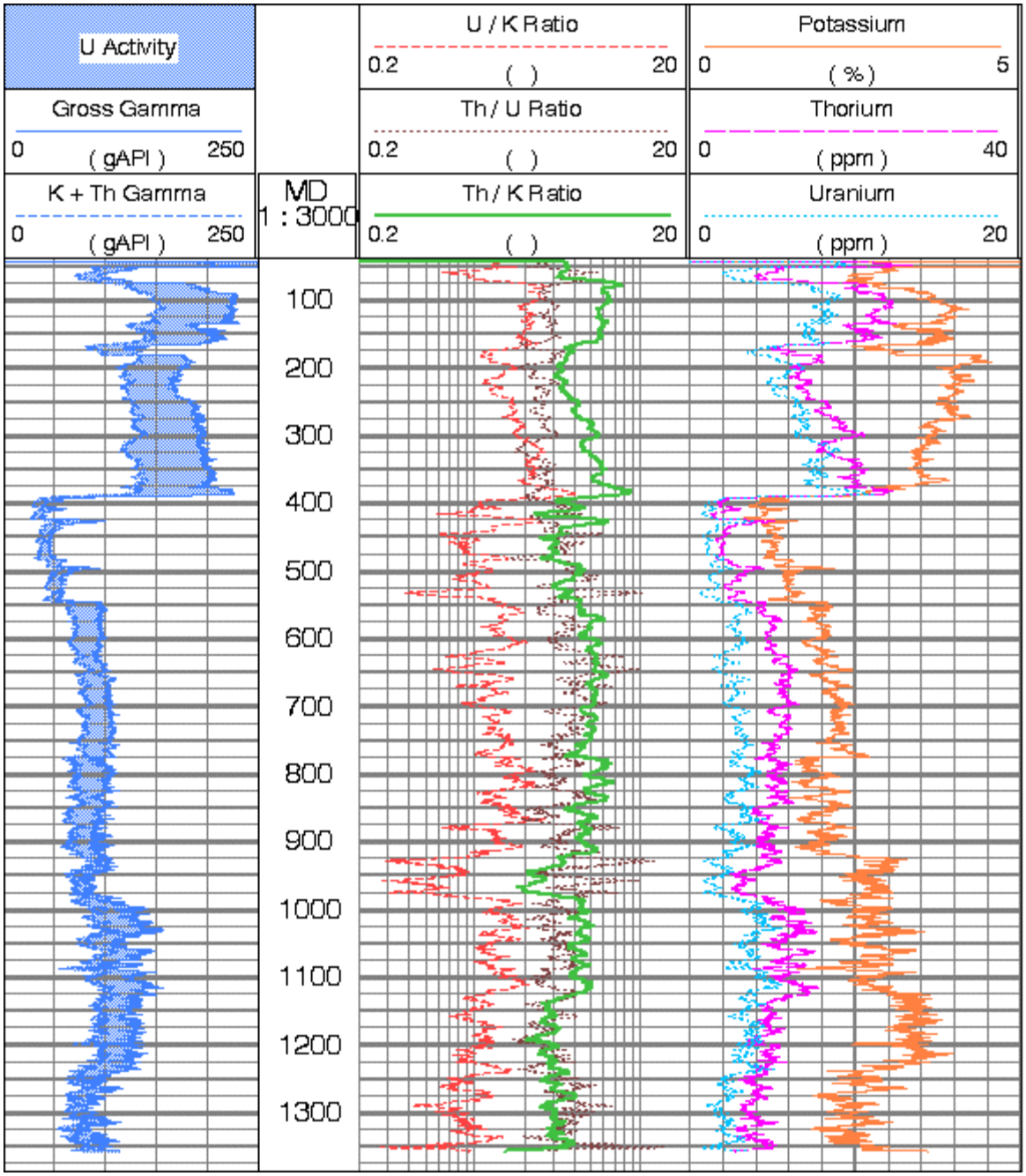


Figure 4.3. Summary spectral natural gamma ray logs from R-20 borehole, interval 50–1365 ft

4.5 Integrated Log Montage

This section describes the integrated geophysical log montage for R-20: It includes a discussion of (1) what each log curve represents and how it was derived and (2) what are some of the most notable features in the displayed logs. The montage is provided in Appendix E of the LANL R-20 Well Completion Report and is shown compressed in Figure 4.4. A description of each log curve in the montage follows—

organized under the heading of each track, starting from track 1 on the left-hand side of the montage. Note that the descriptions in this section focus on what the curves are and how they are displayed; the specific characteristics and interpretations of the R-20 geophysical logs are provided in the previous section.

Track 1–Depth

The first track on the left contains the depth below ground surface in units of feet, as measured by the geophysical logging system during the AITH logging run. All the geophysical logs are depth-matched to the gross gamma measurement run with the AITH. The logs from the second run acquired in September 2002 are depth-matched to the first run acquired in August 2002 using the AITH gross gamma measurement.

Track 2–Basic Logs

The second track on the left (inclusive of the depth track) presents basic curves:

- gamma ray (thick black), recorded in API units and displayed on a scale of 0 to 250 API units;
- two calipers from the FMI (thin dotted and dashed pink) and one from the TLD (thin solid pink) with bit size as a reference (dashed-dotted black) to show washout (pink shading), recorded as hole diameter in inches and displayed on a scale of 11 to 26 in.;
- spontaneous potential or SP (dashed red – valid only below the borehole water level), recorded in millivolts and displayed on a relative scale of -250 to 150 millivolts;
- bulk chlorinity (dashed green with green shading), recorded in parts per thousand (ppk) and displayed on a scale of 50 to 0 ppk (left to right);
- borehole deviation displayed as a tadpole every ten feet (light blue dots and connected line segments) – the “head” marks the angular deviation from vertical at that particular depth, on a scale of zero to 5 degrees, and the “tail” shows the azimuth of the deviation, true north represented by the tail facing straight towards the top of the page.

Two gamma ray curves from the NGS are presented:

- total gross gamma (thick solid black curve) and
- gross gamma minus the contribution of uranium (dashed black).

Gross gamma measurements are sensitive to radioactive elements in the near wellbore environment, which are potassium, thorium, and uranium—assuming the gamma activity is from naturally occurring sources. The response of the gross gamma curves is the result of the formation chemical makeup, including lithology/mineralogy. The gross gamma curve from the NGS is depth-matched to the gamma ray measurement from the AITH tool run.

The two FMI caliper curves are from the tool’s two independent, orthogonal sets of arms containing the four electrode pads; the TLD caliper curve is from the single arm that is used to press the tool sensor against the borehole wall. They have been depth-matched to the AITH tool run using gross gamma ray as a reference. The calipers show a significant amount of washout in the interval 88–440 ft, 518–526 ft, and 828–876 ft. The washouts and hole rugosity do appear to affect measurement quality in some instances, especially the porosity tools—possibly resulting in unrepresentative elevated water-filled or air-filled

porosity in some zones adjacent to large washouts. However, overall, the washouts are not significant, especially compared to other Los Alamos wells. They generally are not abrupt and sharp (i.e. the hole is washed out, but not especially rugose). Hole rugosity has the greatest negative impact on shallow-reading tools since it prevents the sensor section of the tool from contacting the borehole wall; “smooth” washouts do not cause this problem. Consequently, the overall impact of the washouts on log quality in R-20 is minor.

The bulk chlorinity log is estimated from the ECS and is considered an experimental measurement of average water chlorine content seen by the tool—assuming all the chlorine is dissolved in water.

The SP log is measured with the AIT and is only valid in the open hole section.

Borehole deviation is measured with the GPIT, run as part of the FMI across the interval 767–1370 ft. The maximum deviation of the borehole is about 3.4 degrees; the azimuth of deviation is to the north-northeast.

Track 3–Resistivity

The third track displays the resistivity measurements from the AITH, spanning most of the open hole section. All the resistivity logs are recorded in units of ohmmeters and displayed on a logarithmic scale of 2 to 2000 ohm-m.

Six electrical resistivity logs from the AITH are displayed:

- Borehole fluid resistivity (solid orange curve)–only valid and only displayed in water-filled hole (below 755 ft)
- Bulk electrical resistivity at five median depths of investigation–10 in. (black solid), 20 in. (long-dashed blue), 30 in. (short-dashed red), 60 in. (dashed-dotted green), and 90 in. (solid purple)–each having a two-foot vertical resolution.

The area between the 10 in. and 90 in. resistivity curves, representing radial variations in bulk resistivity (potentially from invasion of drilling fluids), is shaded:

- blue when the 10 in. resistivity is greater than the 90 in. resistivity (labeled “resistive invasive”) and
- yellow when the 90 in. resistivity is greater than the 10 in. resistivity (labeled “conductive invasive”).

A high vertical resolution (~8 in.), shallow-reading (~2 in.) micro-resistivity log from the MCFL is also displayed in this track (solid pink curve) below 778 ft. This log measures the bulk electrical resistivity of the “invaded zone” – the zone directly surrounding the borehole that is typically heavily influenced by the drilling process, most notably the replacement of connate formation water with drilling fluids.

The resistivity logs vary across the full-scale range from 2 and 2000 ohm-m (the upper limit of the AITH), but mostly from 5 to 2000 ohm-m, exhibiting a lot of character up and down the borehole. Zones where all the resistivity logs shift left significantly, corresponding to relative low resistivity readings, are likely associated with intervals where clay is present in the formation; in general, the lower resistivity values correlate quite well with increases in the CMR clay-bound moisture measurement. Conversely, zones where the resistivity logs shift right significantly, corresponding to relative high resistivity readings, are

likely associated with intervals where clay is not present in significant amounts and the average pore size is larger or there is not much moisture present in the pore space.

Track 4–Porosity

The fourth track displays the primary porosity log results. All the porosity logs are recorded in units of volumetric fraction and displayed on a linear scale of 0.75 (left side) to negative 0.1 (right side). Specifically, these logs consist of

- CNT water-filled thermal neutron porosity (dashed light blue curve at bottom)–thermal neutron porosity valid (and visible) only in the water-filled borehole (below 755 ft);
- Geochemical estimated water-filled porosity derived from the ECS hydrogen weight % measurement (solid purple), which is probably the best estimate of this property in R-20;
- CMR total water-filled porosity (solid black);
- CMR effective water-filled porosity (dashed green);
- CMR bound water porosity (light blue area shading)–representing by the area between the CMR total and effective water-filled porosities;
- Total porosity derived from bulk density and neutron porosity using 2.65 g/cc grain density (thick long dashed red), 2.25 g/cc (thin dashed red), and 3.05 g/cc (thin dotted red)–with red shading between the 2.25 g/cc and 3.05 g/cc curves; and
- ELAN total water and air-filled porosity (dashed-dotted cyan)–derived from the ELAN integrated analysis of all log curves to estimate optimized matrix and pore volume constituents.

The CNT log is environmentally corrected for borehole conditions–particularly casing and borehole fluid (water or air)–as is the ECS porosity and bulk density (used for density porosity), the latter only requiring casing correction. The ELAN results are based on fully corrected logs. All the porosity logs are depth matched to the NGS log using the gross gamma ray measurement obtained in every logging run.

Track 5–Density

The fifth track displays the:

- bulk density (thick solid maroon curve) on a scale of 1 to 3 grams per cubic centimeter (g/cc);
- P_e (long-dashed black curve) on a scale of 0 to 10 non-dimensional units;
- density correction (dashed orange curve) on a scale of -0.75 to 0.25 g/cc; and
- apparent grain density (dashed-dotted brown curve), derived from the ELAN analysis, on a scale of 2 to 4 g/cc.

Grey area shading is shown where the P_e increases above 3 (indicating the presence of heavy, possibly mafic, minerals) and orange shading is shown where the density correction is greater than the absolute value of 0.25 (indicating the density processing algorithm had to perform a major correction to the bulk density calculation). The bulk density log is environmentally corrected for casing, but cannot be corrected for any annulus behind the casing. These logs have been depth matched to the AITH using gross gamma ray.

Track 6–NGS Spectral Gamma

The sixth track from the left displays the spectral components of the NGS measurement results as wet weight concentrations:

- potassium (solid green curve) in units of percent and on a scale of -5 to 5 percent;
- thorium (dashed brown) in units of parts per million (ppm) and on a scale of 25 to -25 ppm; and
- uranium (dotted blue) in units of parts per million (ppm) and on a scale of 20 to 0 ppm.

The log results are environmentally corrected for borehole conditions (particularly borehole size and fluid properties). Potassium and thorium are presented in such a way that they increase to the right and the left from the center of the track, respectively, with gray shading between the two curves to qualitatively show changes in both concentration values. Uranium is plotted increasing to the left from the right side of the track.

Track 7–CMR Porosity

Track 7 displays various CMR water-filled porosities along with measurement quality flags–valid only in the open hole section. CMR was acquired below 285 ft in R-20. The porosity and measurement quality logs are presented on a scale of 0.5 to zero volume fraction and discrete blocks originating from the left side, respectively. Specifically, the CMR logs shown in this track are

- Total water-filled porosity (solid black curve)–representing the total water volume fraction measured by the CMR;
- Three millisecond (ms) porosity (short-dashed brown)–representing the water volume fraction corresponding to the portion of the CMR measured T2 distribution that is above 3 ms, a cutoff that is considered to be representative of the break between clay-bound water (less than 3 ms) and all other types of water (greater than 3 ms);
- Effective water-filled, or free fluid, porosity (solid pink)–representing the water volume fraction that is moveable (can flow), based on a 33 ms T2 distribution cutoff that is considered representative of the break between bound water (less than 33 ms) and moveable water (greater than 33 ms) in clastic rocks;
- Clay-bound water (brown area shading between total and 3 ms porosity logs)–representing the water volume fraction that is bound within clays;
- Capillary-bound water (pink area shading between 3 ms and effective porosity logs)–representing the water volume fraction that is bound within matrix pores by capillary forces;
- CMR wait-time flag (red area shading)–activates when there is significant measurement response at late T2 times, corresponding to large amounts of completely free (“bathtub”) water and often associated with washouts or very large pores;
- CMR measurement noise flag (yellow and orange area shading)–activates when there is potentially detrimental amounts of measurement noise detected by the tool, at moderate (yellow) and high (orange) levels.

All these CMR logs have been reprocessed from the field measurements to ensure proper and consistent processing algorithms are applied. The reprocessed logs are depth matched to the AITH tool run using gross gamma.

The CMR logs exhibit a significant degree of variability throughout the measured interval, indicating hydrogeologic heterogeneity (variability in pore-size distribution).

Track 8 –Pore Size Distribution

Track 8 displays the water-filled pore size distribution as determined by the CMR–shown as binned water-filled porosities and valid only in the open hole section. CMR was acquired below 285 ft in R-20. The binned porosity logs are presented on a scale of 0.5 to zero volume fraction with colored area shading corresponding to the different bins:

- Clay-bound water–brown area shading;
- Micro pore and small pore water (the sum comprising capillary-bound water)–gray and blue area shading, respectively;
- Medium pore, large pore, and late decay (the sum comprising effective water-filled porosity)–yellow, red, and green area shading, respectively.

Track 9–CMR T2 Distribution (Waveforms)

The CMR T2 distribution is displayed in Track 9 as green waveform traces at discrete depths. CMR was acquired below 285 ft in R-20. The horizontal axis, corresponding to relaxation time in milliseconds, is on a logarithmic scale from 0.3 to 3000 ms. Also plotted are the:

- T2 logarithmic mean (solid blue curve) and
- T2 cutoff time used for differentiating between bound and free water (solid red line)–a constant 33 ms in this case.

Track 10–CMR T2 Distribution (Heated Amplitude)

Track 10 displays the T2 distribution in another way–on a heated color scale where progressively “hotter” color (green to yellow to red) corresponds to increasing T2 amplitude. The remaining aspects of the display are the same as in Track 9, except that the T2 logarithmic mean is shown as a solid white curve and the T2 cutoff is not displayed. CMR was acquired below 285 ft in R-20. The red background of the heated color scale is displayed in the intervals where CMR was not acquired; there was no convenient way to cut off the display.

Track 11–CMR Hydraulic Conductivity

Track 11 displays several estimates of hydraulic conductivity (K) from the CMR measurements, valid only in the open hole section, as well as one derived from the ELAN analysis, presented on a logarithmic scale of 10^{-3} to 10^{7} centimeters per second (cm/s) multiplied by 10^{6}:

- A K versus depth estimate derived from using the SDR permeability equation, converted to hydraulic conductivity (dashed purple curve);
- A K versus depth estimate derived from using the Timur-Coates permeability equation applied to a tapered T2 cutoff, converted to hydraulic conductivity (solid blue curve); and
- An intrinsic K versus depth estimate (assuming full saturation) derived from the ELAN analysis, converted to hydraulic conductivity (dotted pink).

The hydraulic conductivity values have been multiplied by 10^6 to reduce the number of significant figures, since in cm/s the values are very small. Thus, when using these hydraulic conductivity estimates for quantitative analysis, the values should be divided by10^6 or converted to other units.

Area color shading has been applied from the left side of the track up to the Timur-Coates equation K estimate, with different colors corresponding to ranges of K with representative clastic grain sizes:

- Grey–Clay K range (10^{-9} to 10^{-7} cm/s)
- Brown–silt K range (10^{-7} to 10^{-5} cm/s)
- Orange–silty-sand K range (10^{-5} to 10^{-3} cm/s)
- Yellow–clean sand K range (10^{-3} to 10^{-1} cm/s)
- Blue–gravel K range (10^{-1} to 10 cm/s)

Track 12– FMI Image (Dynamic Normalization)

Track 12 displays the FMI image, measured across the interval 786–1370 ft and processed with dynamic normalization so that small-scale electrical resistivity features are amplified in the image. (With dynamic normalization the range of electrical resistivity amplitudes – colors in the image – is normalized across a small moving depth window.) The image is fully oriented and corresponds to the inside of the borehole wall unwrapped, such that the left-hand side represents true north, half-way across the image is south, and the right-hand side is north again. The four color tracks in the image correspond to portions of the borehole wall contacted by the four FMI caliper pads; the blank space in between is the portion of the borehole wall not covered by the pads.

Also displayed are the interpreted bed boundaries (thin blue sinusoids) and cross bedding (red sinusoids).

Track 13– FMI Bedding and Fractures

Track 13 displays the interpreted bed boundaries and fractures picked from the FMI image, shown in two ways:

- Individually as blue (bed boundary), red (cross bedding), and black (conductive fracture) tadpoles at the depths the bedding plane or fracture crosses the midpoint of the borehole – where the “heads” (circles) represent the dip angle and the “tails” (line segments) represent the true dip azimuth (direction the bed is dipping towards);

- Summed as dip azimuth rose histograms (green/red colored fan plots for bed boundaries/fractures) every 50 ft. – where the number of bed boundaries/conductive fractures having a dip direction within a particular sector are summed, thus highlighting the predominant dip directions.

Track 14– FMI Image (Static Normalization)

Track 14 displays the FMI image again, but in a different way – processed with static normalization to highlight larger scale features and trends. (With static normalization the range of electrical resistivity amplitudes – colors in the image – is normalized across the entire length of the log interval.) Again, the FMI image was measured across the open hole interval 786–1370 ft.

Track 15–Sonic Interval Transit Time and Velocity

Track 15 displays the compressional acoustic wave interval transit time (dotted green curve), on a scale of 240 to 40 microseconds per foot, and velocity (solid green curve), on a scale of 0 to 10000 feet per second, measured with the DSLT tool. The log results have been depth matched to the AITH tool run using the gross gamma ray log.

Track 16–Sonic Waveform

Track 16 displays the measured acoustic waveform from one of the receivers in the DSLT tool, displayed as a “variable density log” (VDL) with red as peaks and blue as troughs on a scale of 40 to 1230 microseconds. The VDL has NOT been depth matched to the other logs because doing depth shifting the large array representing the waveform is computationally difficult.

Track 17–Sonic Integrated Transit Time

Track 17 displays the integrated compressional acoustic wave transit time (solid blue curve) starting from the bottom of the sonic log, derived from the DSLT tool measurements and displayed on a scale of 0 to 100,000 microseconds.

Tracks 18 to 22– Geochemical Elemental Measurements

The narrow tracks 18 to 22 present the geochemical measurements iron (Fe) and silicon (Si), sulfur (S) and calcium (Ca), potassium (K) and estimated aluminum (Al), titanium (Ti) and gadolinium (Gd), and hydrogen (H) and bulk chlorinity (Cl) —from left to right respectively, in units of dry matrix weight fraction (except H and K in wet weight fraction, Cl in ppk). All these measurements were obtained from the ECS except K, which is from the NGS. All these measurements are depth matched to the AITH.

Track 23–ELAN Mineralogy Model Results (Dry Weight Fraction)

Track 23 displays the results from the ELAN integrated log analysis (the matrix portion)–presented as dry weight fraction of mineral types chosen in the model:

- Montmorillonite clay (brown/tan)
- Quartz (yellow with small black dots)
- Silica glass (orange)
- Orthoclase or other potassium feldspar (lavender)
- Labradorite or other plagioclase feldspar (pink)
- Hypersthene (purple)
- Hornblende (forest green)
- Augite (maroon)
- Heavy mafic/ultramafic minerals, such as magnetite or olivine (dark green)
- Pyrite (cross-hatched red).

Track 24–ELAN Mineralogy-Pore Space Model Results (Wet Volume Fraction)

Track 24 displays the results from the ELAN integrated log analysis–presented as wet mineral and pore fluid volume fractions:

- Montmorillonite clay (brown/tan)
- Clay-bound water (checkered gray-black)
- Quartz (yellow with small black dots)
- Silica glass (yellow with large black dots)
- Orthoclase or other potassium feldspar (lavender)
- Labradorite or other plagioclase feldspar (pink)
- Pyrite (tan with large black squares).
- Hypersthene (purple)
- Hornblende (forest green)
- Augite (maroon)
- Heavy mafic minerals, such as magnetite (dark army green)
- Air (red)
- Moveable water (white)
- Capillary-bound water (light blue).

Track 25–Summary Logs

Track 25, the second track from the right, displays several summary logs that describe the fluid and air-filled volume measured by the geophysical tools, including water saturation:

- Optimized estimate of total volume fraction water from the ELAN analysis (solid dark blue curve and area shading);
- Optimized estimate of moveable volume fraction water (effective porosity in fully saturated conditions) from the ELAN analysis (dashed cyan curve and green area shading);
- Optimized estimate of total volume fraction of air-filled porosity from the ELAN analysis (solid red curve and dotted red area shading);
- Optimized estimate of water saturation (percentage of pore space filled with water) from the ELAN analysis (dashed-dotted purple curve);
- Water saturation as calculated directly from the bulk density and geochemical estimated porosity using a grain density of 3.05 g/cc (dotted light blue curve), 2.65 g/cc (long-dashed light blue curve), and 2.25 g/cc (dashed light blue curve)–with light blue shading between the 2.25 and 3.05 g/cc saturation curves to show the range;
- Integrated estimated relative water flow from the CMR log that mimics a flow meter (spinner) acquired under flowing conditions (solid black line coming from left-hand side at bottom of logged interval);
- Potential for water flow indicator from the CMR log (block green cross-hatched shading coming from the right-hand side of the track).

The porosity curves scale from 0 to 0.5 volume fraction, left to right; the water saturation scales from 0 to 1 volume fraction of pore space, from left to right. The relative water flow is on a scale of 0 to 1 relative volumetric flow rate from left to right. The flow indicator is a binary-valued flag that rises to halfway through the first division from the right on the x-axis when the CMR measurement indicates a potential for flow.

Track 26–Depth

The final track on the right, same as the first track on the left, displays the depth below ground surface in units of feet, as measured by the geophysical logging system during the AITH logging run.

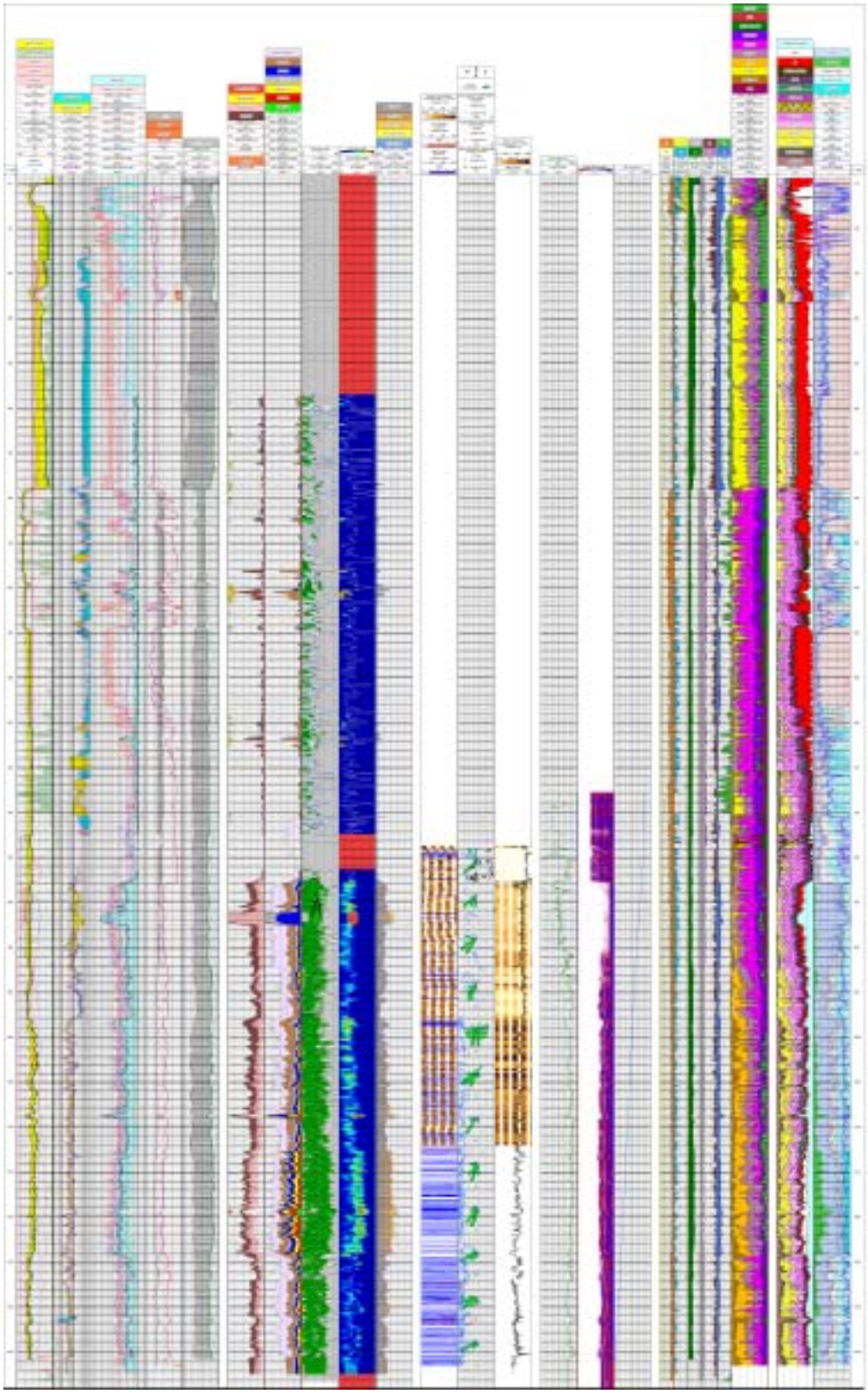


Figure 4.4. Geophysical log montage showing a compressed composite of all processed logs, including ELAN models, from borehole R-20.

5.0 REFERENCES

Kenyon, B., R. Kleinberg, C. Straley, G. Gubelin, and C. Morris: 1995. “Nuclear Magnetic Resonance Imaging— Technology for the 21st Century.” Oilfield Review, v. 7, n. 3, p. 19–33.

Mayer, C. and A. Sibbit, 1980. “GLOBAL, A New Approach to Computer-Processed Log Interpretation.” Paper SPE 9341 presented at the 1980 SPE Annual Technical Conference and Exhibition.

Quirein, J., S. Kimminau, J. LaVigne, J. Singer, and F. Wendel. 1986. “A Coherent Framework for Developing and Applying Multiple Formation Evaluation Models.” Paper DD in 27th Annual Logging Symposium Transactions: Society of Professional Well Log Analysts.

Schlumberger, Log Interpretation Charts 1998 (SMP-7006).

Schlumberger, Log Interpretation Principles/Applications 1989 (SMP 7017)

Schlumberger, Log Quality Control Manual. 1997

Appendix F

Westbay™ Multi-Level Sampling Diagram
(CD attached to inside back cover)

Summary MP Casing Log

Company: Los Alamos National Lab
Well: R20
Site: LANL
Project: Hydrogeology Study

Job No: WB777
Author: DL/GG

Well Information

Reference Datum: Ground Level
Elevation of Datum: 0.00 ft.
MP Casing Top: 0.00 ft.
MP Casing Length: 1352.06 ft.
Depth Adjusted For:
Field De-Stressing
Well Description:
PlasticMP55
Other References:
Pipe-based wire-wrapped screens.
BF and screens: LANL As-Built 9-27-02
All depths nominal (cold meas. lengths)

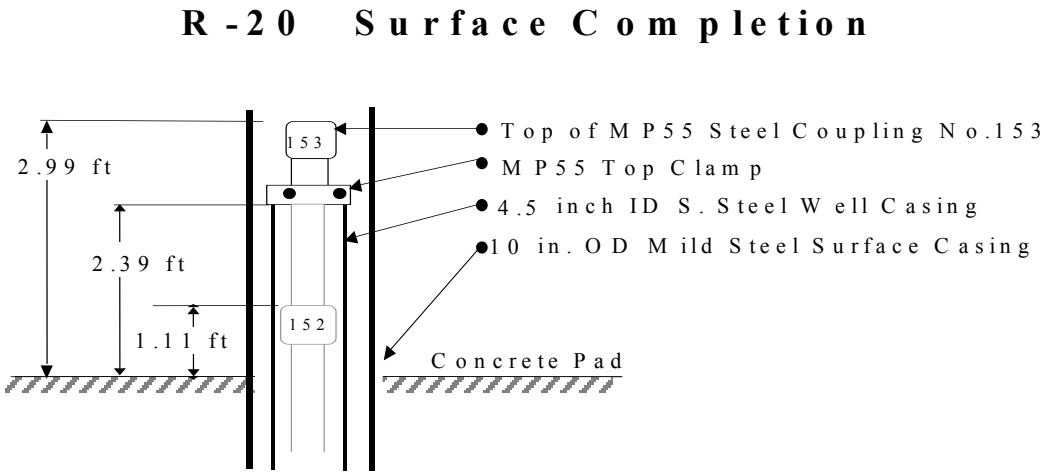
Borehole Depth: 1365.00 ft.
Borehole Inclination: vertical
Borehole Diameter: 4.50 in.

File Information

File Name: 777_R20.WWD
Report Date: Sun Jan 19 14:48:46 2003

File Date: Jan 19 14:21:02 2003

Sketch of Wellhead Completion



Legend

(Qty) MP Components

(Library - WD Library 7/27/00)

(2) 0603 - MP55 End Plug

(7) 0601M10 - MP55 Casing, 1.0 m, PVC

(124) 0601M30 - MP55 Casing, 3.0 m, PVC

(10) 0612 - MP55 Packer, Stiffened, SS

(12) 0601M15 - MP55 Casing, 1.5 m, PVC

(138) 0602 - MP55 Regular Coupling

(14) 0605 - MP55 Measurement Port

(3) 0607 - MP55 Hydraulic Pumping Port

(6) 0608 - MP55 Magnetic Location Collar

Geology

Conglomerate

Rock

Sandstone, Coarse

Lava, Basaltic

Backfill/Casing

Concrete

Bentonite

Sand Fine

Sand Coarse

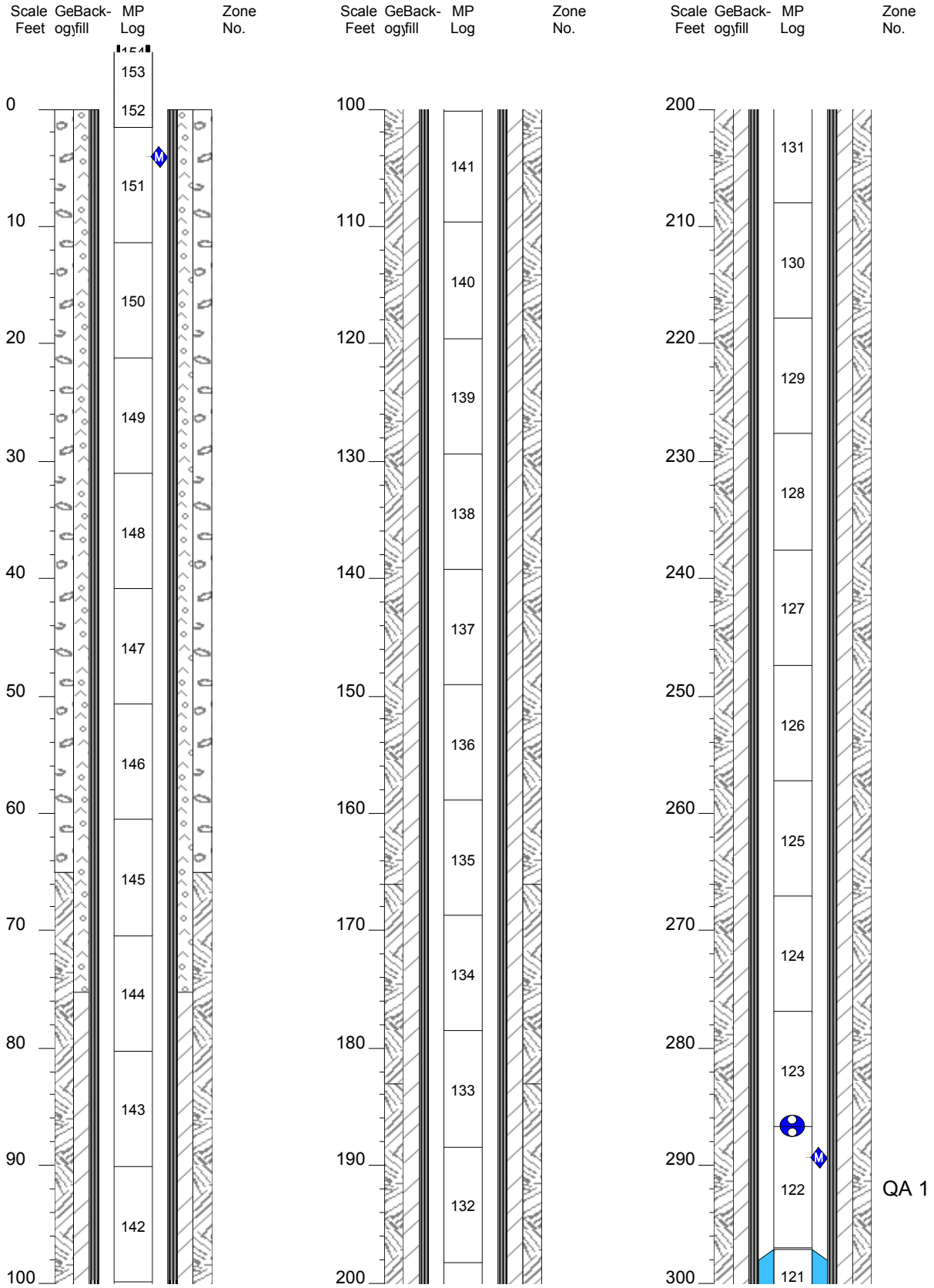
Native / Cave

Stainless Steel

Well Screen

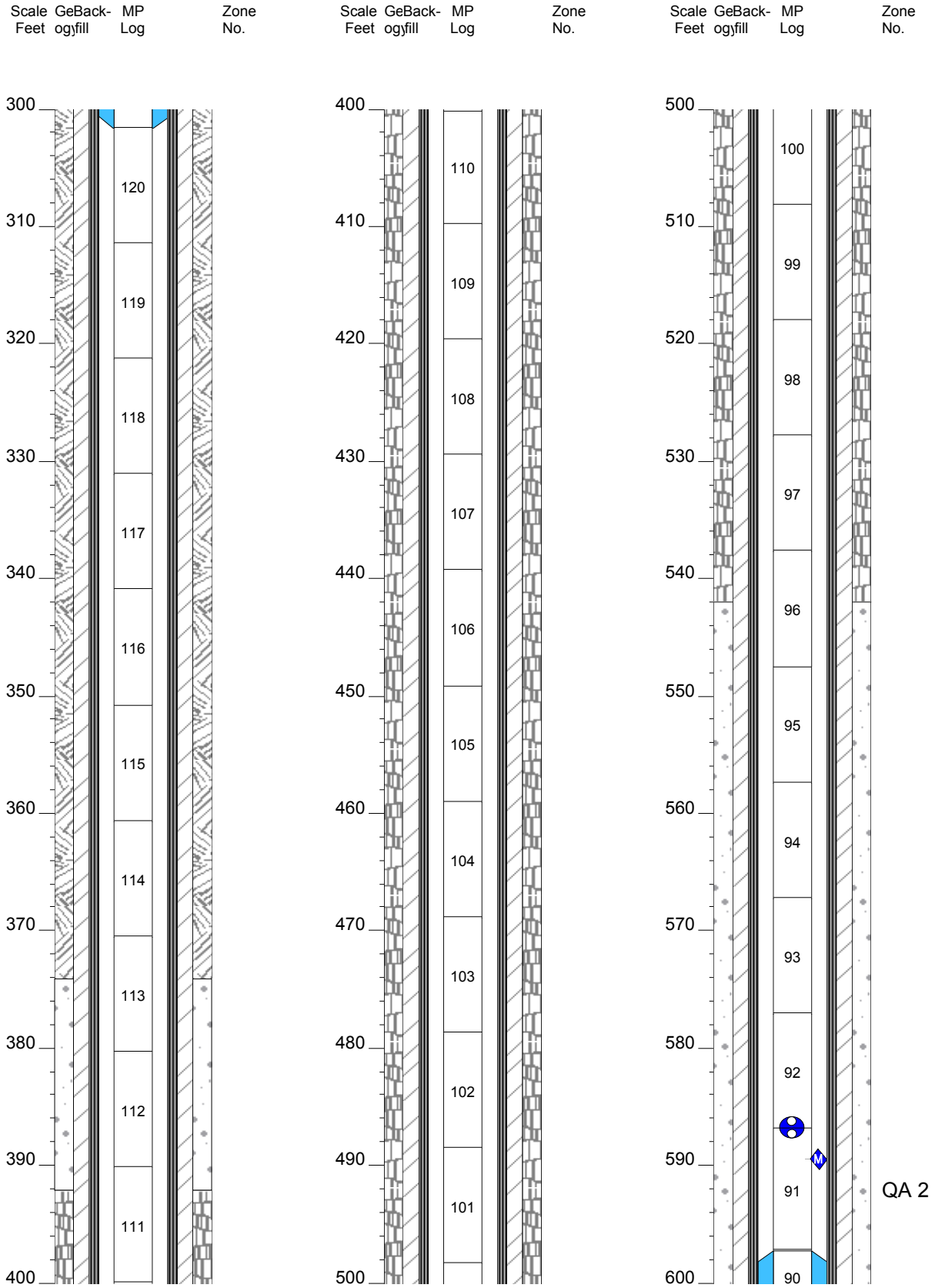
Summary MP Casing Log
Los Alamos National Lab

Job No: WB777
Well: R20



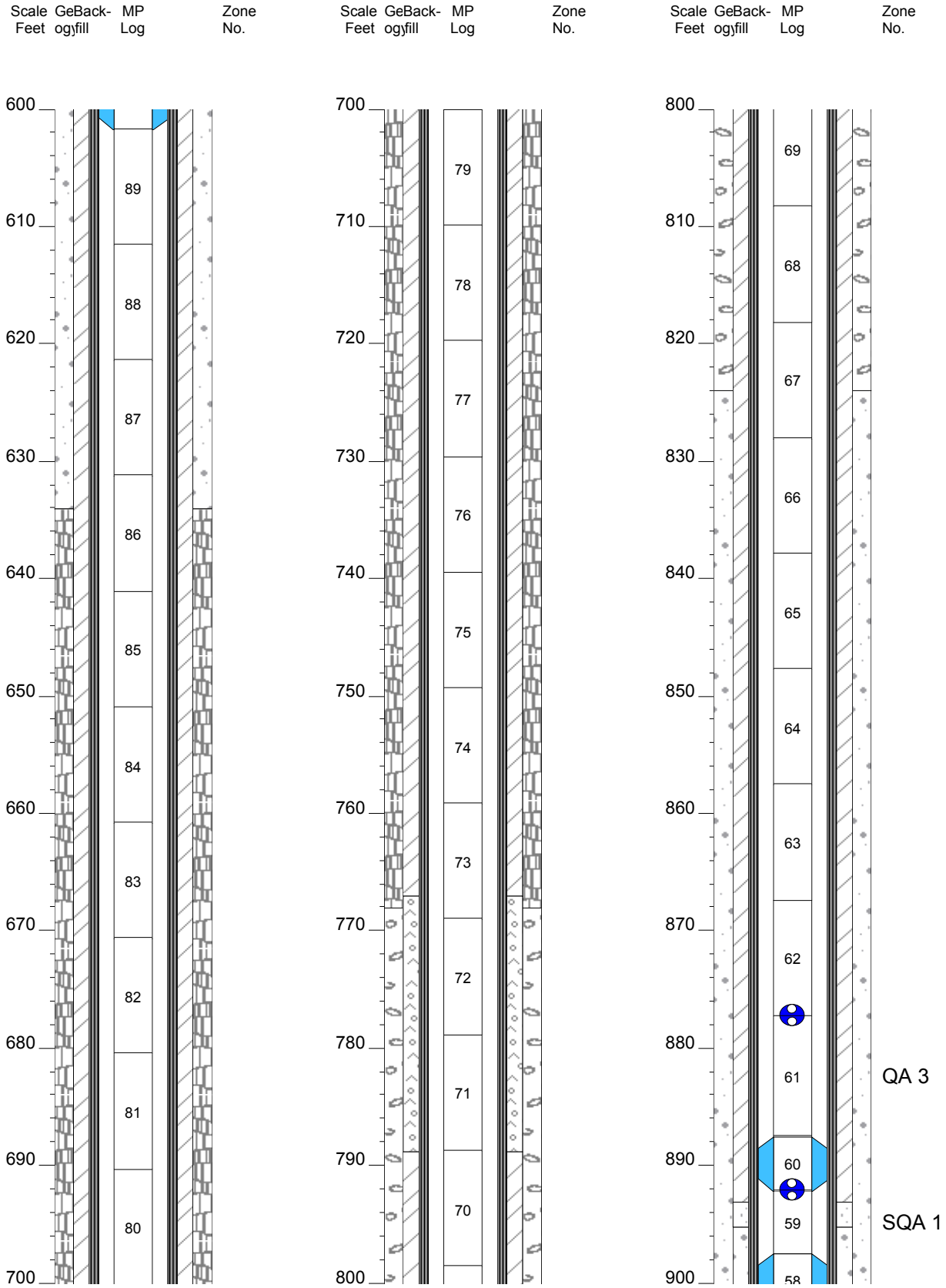
Summary MP Casing Log
Los Alamos National Lab

Job No: WB777
Well: R20



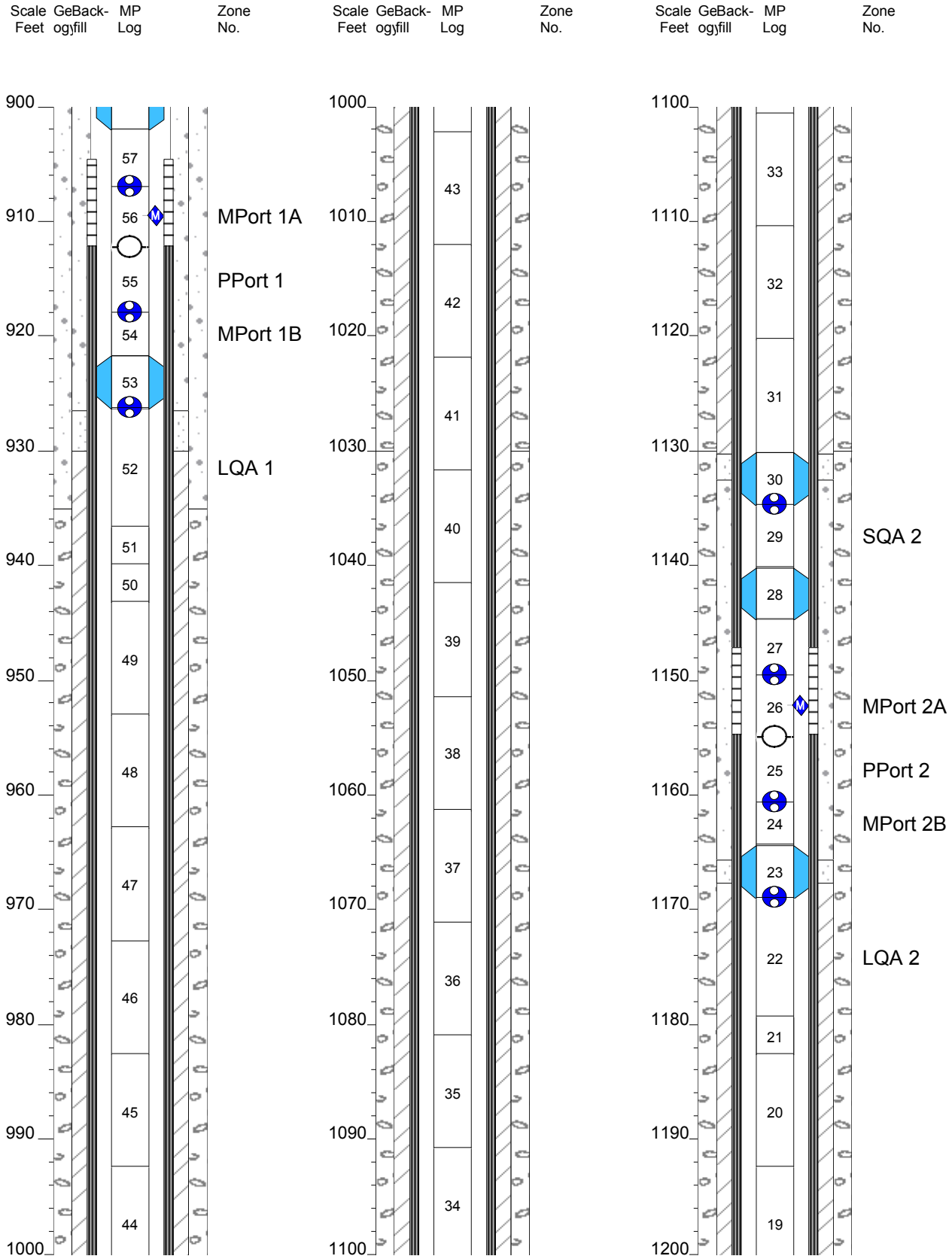
Summary MP Casing Log
Los Alamos National Lab

Job No: WB777
Well: R20



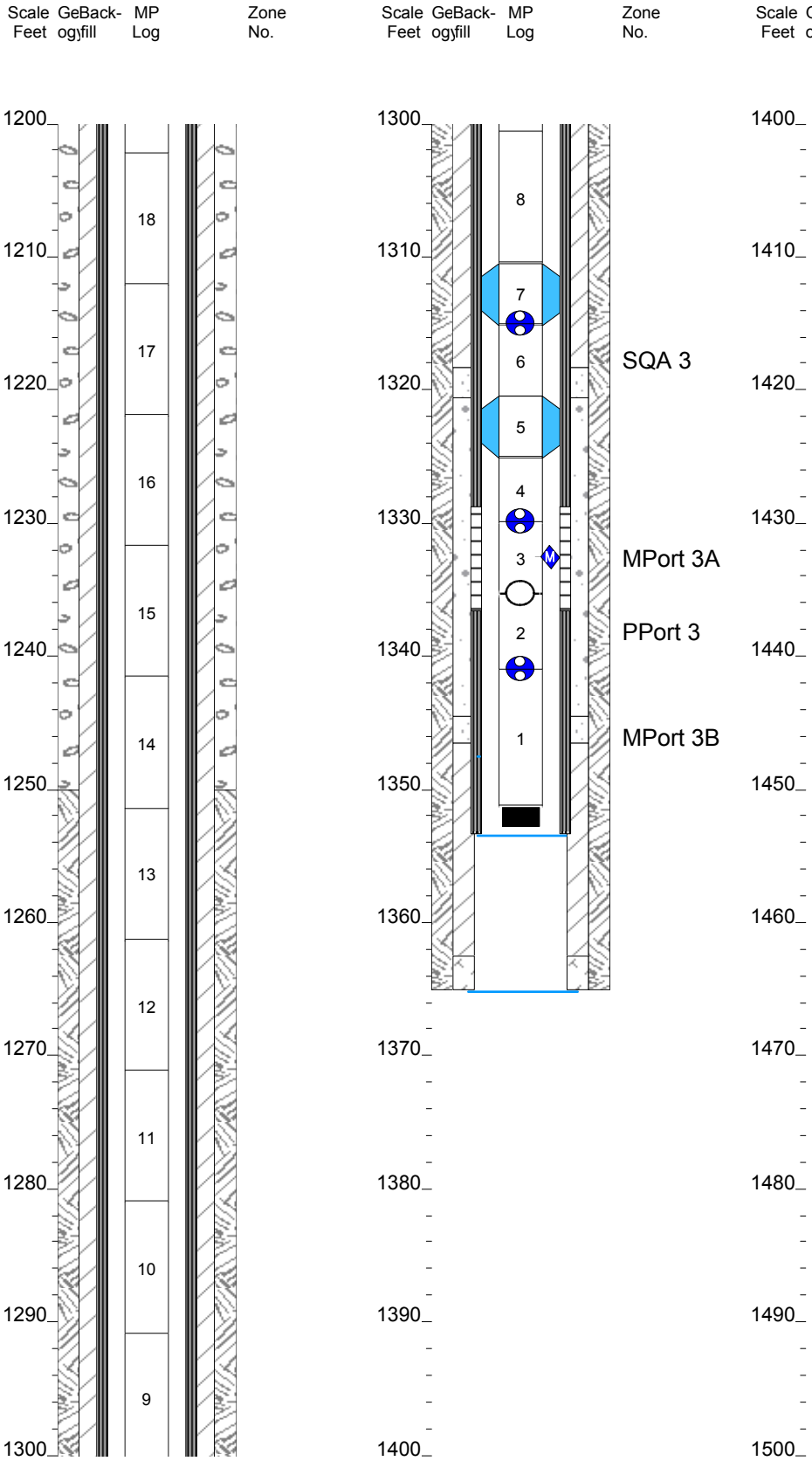
Summary MP Casing Log
Los Alamos National Lab

Job No: WB777
Well: R20



Summary MP Casing Log
Los Alamos National Lab

Job No: WB777
Well: R20



Appendix G

Waste Characterization Data

Los Alamos
NATIONAL LABORATORY

Risk Reduction & Environmental Stewardship Division
Water Quality & Hydrology Group (RRES-WQH)
PO Box 1663, MS K497
Los Alamos, New Mexico 87545
(505) 667-7969/Fax: (505) 665-9344

Date: November 7, 2002
Refer to: RRES-WQH: 02-417

Mr. John Young
Hazardous Materials Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, New Mexico 87502

Mr. Curt Frischkorn
Ground Water Quality Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, New Mexico 87502

SUBJECT: NOTICE OF INTENT TO DISCHARGE, HYDROGEOLOGIC WORKPLAN WELL R-20

Dear Mr. Young and Mr. Frischkorn:

This week the Laboratory will begin discharging drilling water from Hydrogeologic Workplan Well R-20 in accordance with the Hydrogeologic Workplan Notice of Intent (NOI) submitted to your agency on August 2, 2001, and subsequently revised on July 16, 2002. Under the Hydrogeologic Workplan NOI, if drilling water produced from a Workplan Well is compliant with New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 ground water standards and applicable RCRA regulatory limits then the Laboratory can discharge without prior coordination with the NMED. Since the drilling water produced from Workplan Well R-20 meets the above requirements, the Laboratory is proceeding with land application.

The Laboratory containerized approximately 100,000 gallons of water produced during the drilling of Workplan Well R-20. Workplan Well R-20 is located on Pajarito Road southeast of Technical Area (TA)-18. Due to the presence of alluvial ground water in the vicinity of Workplan Well R-20 (alluvial water was observed from 9.5 ft. to 57.5 ft.), the drilling water will be applied to the road leading into Mortandad Canyon from TA-52. Depth to ground water at the land application site is approximately 1260 feet. As required by the Workplan NOI, no ponding, pooling, or run-off of the discharged water will be permitted. Information regarding the quality of the Workplan Well R-20 water is provided below.

Water Quality Data

Attachment 1.0 contains analytical reports (metals, general chemistry, perchlorate, nitrate, tritium, and high explosives) from the sampling of containerized drilling water from Workplan Well R-20. All samples were filtered (with the exception of total Hg) prior to analysis. Sample results are compliant with all NM WQCC Regulation 3103 ground water standards including the following contaminants of concern:

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Mr. Young and Mr. Frischkorn - 2 - November 7, 2002
RRES-WQH:02-417

Contaminants Of Concern	Screening Result (mg/L)	NM WQCC ground water standard (mg/L)
total Hg	ND	0.002
HE	ND	
tritium	ND	
Mn	0.013	0.2
perchlorate	ND	
nitrate (as N)	2.76	10.0

Please call me at (505) 667-6969 or Roy Bohn of the Laboratory's Environmental Restoration Project (RRES-R) at (505) 665-5138 if additional information is required.

Sincerely,

Bob Beers
Water Quality & Hydrology Group

BB/tml

Enclosures: a/s

Cy: M. Leavitt, NMED/GWQB, Santa Fe, NM, w/enc.
J. Davis, NMED/SWQB, Santa Fe, NM, w/enc.
J. Bearzi, NMED/HWB, Santa Fe, NM, w/enc.
J. Vozella, DOE/OLASO, w/o enc., MS A316
G. Turner, DOE/OLASO, w/enc., MS A316
M. Johansen, DOE/OLASO, w/enc., MS A316
B. Ramsey, RRES-DO, w/o enc., MS J591
K. Hargis, RRES-DO, w/o enc, MS J591
D. Stavert, RRES-EP, w/enc., MS J591
C. Nylander, RRES-GP, w/o enc., MS M992
S. Rae, RRES-WQH, w/enc., MS K497
D. Rogers, RRES-WQH, w/o enc., MS K497
M. Saladen, RRES-WQH, w/o enc., MS K497
J. McCann, RRES-WQH, w/o enc., MS M992
R. Bohn, RRES-R, w/enc., MS M992
D. Volkman, FWO-UI, w/o enc., MS K718
RRES-WQH File, w/enc., MS K497
IM-5, w/enc., MS A150

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ATTACHMENT 1.0

HYDROGEOLOGIC WORKPLAN
WELL R-20

CONTAINERIZED DRILLING WATER

ANALYTICAL REPORTS:

- GENERAL CHEMISTRY
- METALS
- PERCHLORATE
- NITRATE/NITRITE
- HE
- TRITIUM

Hydrogeologic Workplan Well R-20
Drilling Water Screening Results

ER

ER WATER SAMPLES

SAMPLE ID	DESCRIPTION	DATE MM/DD/YY	ER Req#	Ag ppm	Al ppm	Std.D. +/-	As ppm	Std.D. +/-	B ppm	Std.D. +/-	Ba ppm
GW20-02-48099	R-20 mud, analyzed after filtering	09/12/02	1192S	<0.0003	0.25	0.01	0.023	0.001	0.090	0.001	0.049
GW20-02-48100	R-20 mud, analyzed after filtering	09/12/02	1192S	<0.0003	0.58	0.01	0.012	0.001	0.098	0.002	0.021

Page 1

Hydrogeologic Workplan Well R-20
Drilling Water Screening Results

ER

SAMPLE ID	Std.D. +/-	Be ppm	Br ppm	Ca ppm	Std.D. +/-	Cd ppm	Cl ppm	ClO3 ppm	ClO4 ppm	Co ppm	Std.D. +/-	Cr ppm	Std.D. +/-	Cs ppm	Cu ppm
GW20-02-48099	0.001	<0.002	<0.1	20.0	0.1	<0.001	11.2	<0.1	<0.01	<0.001		0.029	0.001	<0.003	0.026
GW20-02-48100	0.001	<0.002	<0.1	15.1	0.4	<0.001	12.2	<0.1	<0.01	<0.001		0.0082	0.0002	<0.003	0.025

Page 2

Hydrogeologic Workplan Well R-20
Drilling Water Screening Results

ER

SAMPLE ID	Std.D. +/-	F ppm	Fe ppm	Std.D. +/-	Hardness CaCO3 ppm	Hg ppm	Std.D. +/-	K ppm	Std.D. +/-	Li ppm	Std.D. +/-	Mg ppm	Std.D. +/-	Mn ppm	Std.D. +/-
GW20-02-48099	0.001	0.65	0.07	0.01	56.4	0.0045*	0.0001	7.53	0.02	0.049	0.001	1.58	0.01	0.013	0.001
GW20-02-48100	0.001	0.60	0.19	0.01	48.8	0.0039*	0.0001	8.83	0.16	0.081	0.001	2.70	0.02	0.012	0.001

***REANALYSIS RESULTS: NON DETECT. SEE ATTACHED.**

Page 3

Hydrogeologic Workplan Well R-20
Drilling Water Screening Results

ER

SAMPLE ID	Mo ppm	Std.D. +/-	Na ppm	Std.D. +/-	Ni ppm	Std.D. +/-	NO2 ppm	NO3 ppm	N total ppm	Oxalate ppm	Pb ppm	Std.D. +/-	PO4 ppm	Rb ppm	Std.D. +/-
GW20-02-48099	0.095	0.001	255	2	0.0065	0.0002	1.08	2.76	0.95	1.03	<0.0005		1.95	0.022	0.001
GW20-02-48100	0.097	0.002	274	1	0.0070	0.0001	0.73	2.62	0.81	1.04	0.0007	0.0001	3.26	0.013	0.001

Page 4

Hydrogeologic Workplan Well R-20
Drilling Water Screening Results

ER

SAMPLE ID	Sb ppm	Sb Std.D. +/-	Se ppm	Se Std.D. +/-	Si ppm	Si Std.D. +/-	SiO2 ppm calc	SO4 ppm	Sn ppm	Sr ppm	Sr Std.D. +/-	Th ppm	Th Std.D. +/-	Ti ppm	Ti Std.D. +/-
GW20-02-48099	0.0027	0.0001	0.005	0.001	23.5	0.1	50.3	237	<0.002	0.23	0.01	<0.001		<0.001	
GW20-02-48100	0.0048	0.0001	0.003	0.001	18.0	0.1	38.5	229	<0.002	0.19	0.01	<0.001		0.005	0.001

Page 5

Hydrogeologic Workplan Well R-20
Drilling Water Screening Results

ER

SAMPLE ID	Tl ppm	U ppm	Std.D. +/-	V ppm	std.D. +/-	Zn ppm	Std.D. +/-	Acetate ppm	Formate ppm	comments
GW20-02-48099	<0.002	0.011	0.001	0.032	0.001	0.003	0.001	+	+	unknown peak before NO3
GW20-02-48100	<0.002	0.011	0.001	0.015	0.001	0.004	0.001	+	+	unknown peak before NO3

Page 6

Certificate of Analysis

Company : Los Alamos National Lab
Address : PO Box 1663
TA-3, Bldg. 271, Drop Pt. 01U
Los Alamos, New Mexico 87545
Contact: Keith Greene
Project: Groundwater Project

Report Date: October 24, 2002

Page 1 of 1

Client Sample ID:	GW20-02-49610 10	Project:	LANL00401
Sample ID:	68196001	Client ID:	LANL004
Matrix:	Ground Water		
Collect Date:	01-OCT-02 00:00		
Receive Date:	03-OCT-02		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Mercury Analysis Federal										
7470 Cold Vapor Hg Liquid										
Mercury	U	ND	0.0472	0.200	ug/L	1	NOR1 10/22/02	1214	207403	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 7470A Prep	EPA 7470A Mercury Prep Liquid	KHN	10/21/02	1630	207402

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	

Notes:
The Qualifiers in this report are defined as follows :

< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
BD Flag for results below the MDC or a flag for low tracer recovery.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
P The response between the confirmation column and the primary column is >40%D
U Indicates the compound was analyzed for but not detected above the detection limit
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier - must be fully described in case narrative and data summary package
Y QC Samples were not spiked with this compound.

The above sample is reported on an "as received" basis.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Stacy Griffin.

Reviewed by

Certificate of Analysis

Company : Los Alamos National Lab
Address : PO Box 1663
TA-3, Bldg. 271, Drop Pt. 01U
Los Alamos, New Mexico 87545
Contact: Keith Greene
Project: Groundwater Project

Report Date: October 24, 2002

Page 1 of 1

Client Sample ID: GW20-02-49611 10
Sample ID: 68196002
Matrix: Ground Water
Collect Date: 01-OCT-02 00:00
Receive Date: 03-OCT-02
Collector: Client

Project: LANL00401
Client ID: LANL004

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Mercury Analysis Federal										
7470 Cold Vapor Hg Liquid										
Mercury	U	ND	0.0472	0.200	ug/L	1	NOR1 10/22/02	1259	207403	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 7470A Prep	EPA 7470A Mercury Prep Liquid	KHN	10/21/02	1630	207402

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	

Notes:
The Qualifiers in this report are defined as follows :

< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
BD Flag for results below the MDC or a flag for low tracer recovery.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
P The response between the confirmation column and the primary column is >40%D
U Indicates the compound was analyzed for but not detected above the detection limit
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier - must be fully described in case narrative and data summary package
Y QC Samples were not spiked with this compound.

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This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Stacy Griffin.

Reviewed by

Certificate of Analysis

Company : Los Alamos National Lab
Address : PO Box 1663
TA-3, Bldg. 271, Drop Pt. 01U
Los Alamos, New Mexico 87545
Contact: Keith Greene
Project: Groundwater Project

Report Date: October 16, 2002

Page 1 of 2

Client Sample ID:	GW20-02-49610 13/14/15	Project:	LANL00401
Sample ID:	68195001	Client ID:	LANL004
Matrix:	Ground Water		
Collect Date:	01-OCT-02 00:00		
Receive Date:	03-OCT-02		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
HPLC-EXPL Federal										
HEXP / HEXPU										
1,3,5-Trinitrobenzene	U	ND	0.249	1.04	ug/L	1	JLW 10/08/02	2027	206481	1
2,4,6-Trinitrotoluene	U	ND	0.779	1.04	ug/L	1				
2,4-Dinitrotoluene	U	ND	0.349	1.04	ug/L	1				
2,6-Dinitrotoluene	U	ND	0.501	1.04	ug/L	1				
2-Amino-4,6-dinitrotoluene	U	ND	0.779	1.04	ug/L	1				
4-Amino-2,6-dinitrotoluene	U	ND	0.409	1.04	ug/L	1				
HMX	U	ND	0.779	1.04	ug/L	1				
Nitrobenzene	U	ND	0.131	1.04	ug/L	1				
RDX	U	ND	0.530	1.04	ug/L	1				
Tetryl	U	ND	0.320	1.04	ug/L	1				
m-Dinitrobenzene	U	ND	0.330	1.04	ug/L	1				
m-Nitrotoluene	U	ND	0.640	1.04	ug/L	1				
o-Nitrotoluene	U	ND	0.640	1.04	ug/L	1				
p-Nitrotoluene	U	ND	0.640	1.04	ug/L	1				

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 8330 PREP	8330 EXPLOSIVES BY HPLC Prep in liquid	GMS	10/07/02	1000	206479

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8330	

Surrogate recovery	Test	Recovery%	Acceptable Limits
1,2-dinitrobenzene	HEXP / HEXPU	0%*	(59%-118%)

Notes:
The Qualifiers in this report are defined as follows :

< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.

Certificate of Analysis

Company : Los Alamos National Lab
Address : PO Box 1663
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Los Alamos, New Mexico 87545
Contact: Keith Greene
Project: Groundwater Project

Report Date: October 16, 2002

Page 1 of 2

Client Sample ID: GW20-02-49611 13/14/15
Sample ID: 68195002
Matrix: Ground Water
Collect Date: 01-OCT-02 00:00
Receive Date: 03-OCT-02
Collector: Client

Proiect: LANL00401
Client ID: LANL004

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
HPLC-EXPL Federal											
HEXP / HEXPU											
1,3,5-Trinitrobenzene	U	ND	0.249	1.04	ug/L	1	JLW	10/08/02	2110	206481	1
2,4,6-Trinitrotoluene	U	ND	0.779	1.04	ug/L	1					
2,4-Dinitrotoluene	U	ND	0.349	1.04	ug/L	1					
2,6-Dinitrotoluene	U	ND	0.501	1.04	ug/L	1					
2-Amino-4,6-dinitrotoluene	U	ND	0.779	1.04	ug/L	1					
4-Amino-2,6-dinitrotoluene	U	ND	0.409	1.04	ug/L	1					
HMX	U	ND	0.779	1.04	ug/L	1					
Nitrobenzene	U	ND	0.131	1.04	ug/L	1					
RDX	U	ND	0.530	1.04	ug/L	1					
Tetryl	U	ND	0.320	1.04	ug/L	1					
m-Dinitrobenzene	U	ND	0.330	1.04	ug/L	1					
m-Nitrotoluene	U	ND	0.640	1.04	ug/L	1					
o-Nitrotoluene	U	ND	0.640	1.04	ug/L	1					
p-Nitrotoluene	U	ND	0.640	1.04	ug/L	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 8330 PREP	8330 EXPLOSIVES BY HPLC Prep in liquid	GMS	10/07/02	1000	206479

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8330	

Surrogate recovery	Test	Recovery%	Acceptable Limits
1,2-dinitrobenzene	HEXP / HEXPU	20% *	(59%-118%)

Notes:
The Qualifiers in this report are defined as follows :

< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
P The response between the confirmation column and the primary column is >40%D

Certificate of Analysis

Company : Los Alamos National Lab
Address : PO Box 1663
TA-3, Bldg. 271, Drop Pt. 01U
Los Alamos, New Mexico 87545
Contact: Keith Greene
Project: Groundwater Project

Report Date: September 23, 2002

Page 1 of 1

Client Sample ID:	GW20-02-48099 02/03	Project:	LANL00401
Sample ID:	67098001	Client ID:	LANL004
Matrix:	Misc Liquid		
Collect Date:	12-SEP-02		
Receive Date:	14-SEP-02		
Collector:	Client		

Parameter	Qualifier	Result	DL	TPU	RL	Units	DF	AnalystDate	Time	Batch Mtd.
Rad Liquid Scint										
LSC, Tritium Dist, Liquid										
Tritium		-180	372	108	250	pCi/L		CAF1 09/20/02	1458	202687 1

The following Analytical Methods were performed

Method	Description
1	EPA 906.0

Notes:
TPU is calculated at the 67% confidence level (1-sigma).
The Qualifiers in this report are defined as follows :

< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
P The response between the confirmation column and the primary column is >40%D
U Indicates the compound was analyzed for but not detected above the detection limit
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Stacy Griffin.

Reviewed by

Certificate of Analysis

Company: Los Alamos National Lab
Address: PO Box 1663
TA-3, Bldg. 271, Drop Pt. 01U
Los Alamos, New Mexico 87545
Contact: Keith Greene
Project: Groundwater Project

Report Date: September 23, 2002

Page 1 of 1

Client Sample ID:	GW20-02-48100 02/03	Project:	LANL00401
Sample ID:	67098002	Client ID:	LANL004
Matrix:	Misc Liquid		
Collect Date:	12-SEP-02		
Receive Date:	14-SEP-02		
Collector:	Client		

Parameter	Qualifier	Result	DL	TPU	RL	Units	DF	AnalystDate	Time	Batch	Mtd.
Rad Liquid Scint											
LSC, Tritium Dist, Liquid											
Tritium		184	381	121	250	pCi/L		CAF1 09/20/02	1629	202687	1

The following Analytical Methods were performed

Method	Description
1	EPA 906.0

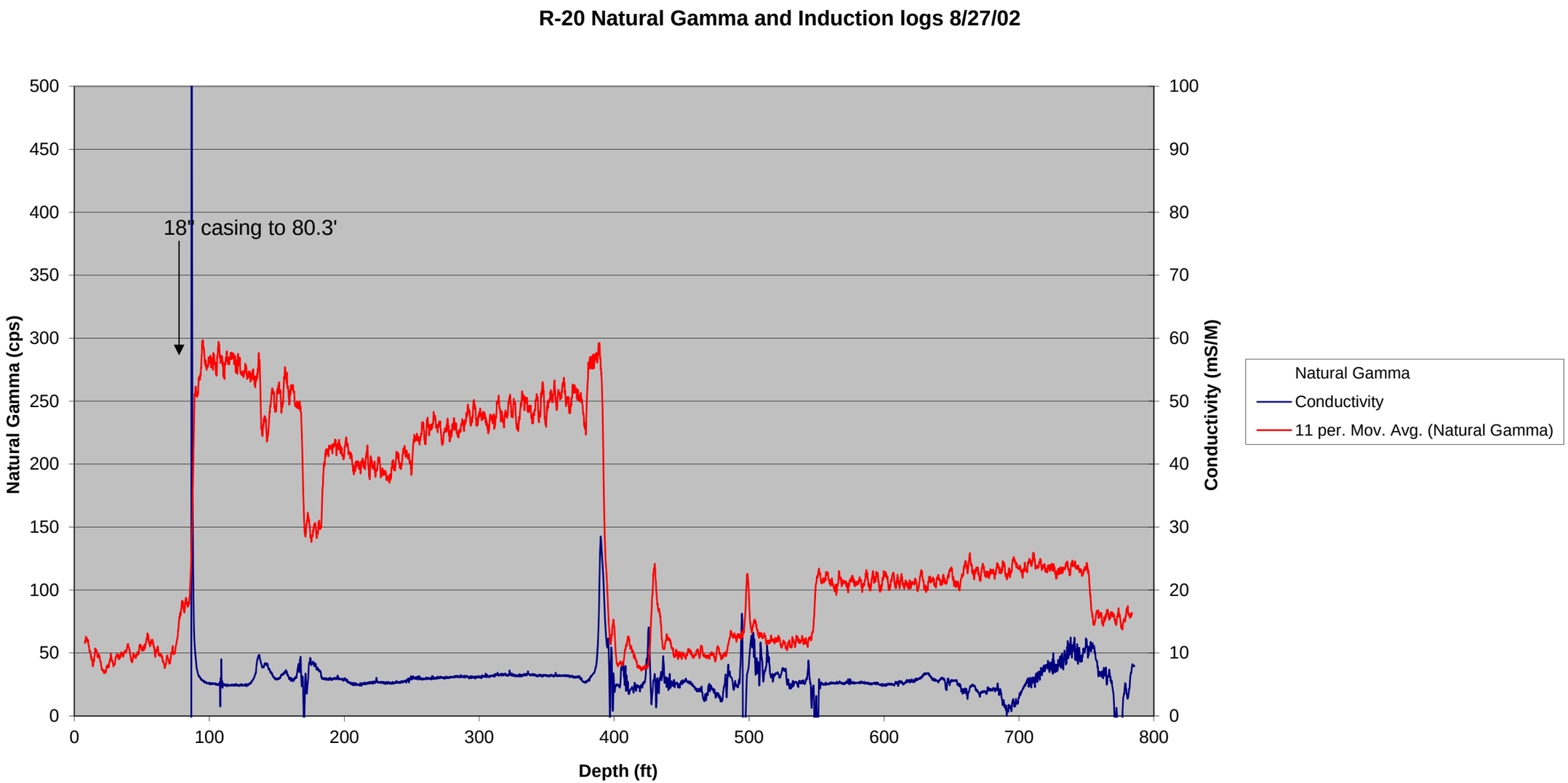
Notes:
TPU is calculated at the 67% confidence level (1-sigma).
The Qualifiers in this report are defined as follows :

< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
P The response between the confirmation column and the primary column is >40%D
U Indicates the compound was analyzed for but not detected above the detection limit
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Stacy Griffin.

Reviewed by


R-20 Natural Gamma and Induction logs 8/27/02
18" casing to 80.3'
Natural Gamma (cps)
Conductivity (mS/M)
Depth (ft)
0
50
100
150
200
250
300
350
400
450
500
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
Natural Gamma
Conductivity
11 per. Mov. Avg. (Natural Gamma)

```
~VERSION INFORMATION
VERS                    .2.0                          :CWLS LOG ASCII STANDARD-VERSION 2.0
WRAP                    .NO                           :ONE LINE PER DEPTH STEP
~WELL INFORMATION
STRT                    .FT                   7.74271 :START DEPTH
STOP                    .FT                   150.294 :STOP DEPTH
STEP                    .FT                         0 :STEP
NULL                    .                     -999.25 :NULL VALUE
COMP                    .         N/A                 :COMPANY
WELL                    .         N/A                 :WELL
FLD                     .         N/A                 :FIELD
LOC                     .         N/A                 :LOCATION
PROV                    .         N/A                 :PROVINCE
SRVC                    .         N/A                 :SERVICE COMPANY
DATE                    .         N/A                 :LOG DATE
UWI                     .         N/A                 :UNIQUE WELL ID
~CURVE INFORMATION
DEPT                    .FT                           :DEPTH
COND                    .MS/M                         :Cond.
GAMM                    .CPS                          :Gamma
I__R                    .OHM-M                        :I. Res.
~PARAMETER INFORMATION
Dept                    .                             :Depth Logger
BH F                    .         742 ft              :BH Fluid
COMP                    .         WGII                :COMPANY:
Dept                    .         785 ft              :Depth Driller
File                    .         r14gamma_071202     :File Name
Witn                    .                             :Witness:
Loca                    .         Pajarito Canyon     :Location:
Casi                    .         80 ft               :Casing
Well                    .         R-20                :Well
Date                    .                   7/12/2002 :Date
Logg                    .         Andy Crowder        :Logged by:
~OTHER
~A
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59.4154	-234.523	17.958	-4.26397
59.5795	-234.523	29.8008	-4.26397
59.7435	-234.523	89.7773	-4.26397
59.9075	-234.523	53.5625	-4.26397
60.0716	-234.523	41.9648	-4.26397
60.2356	-234.523	39.2383	-4.26397
60.3997	-234.523	60.3535	-4.26397
60.5637	-234.523	45.0742	-4.26397
60.7277	-234.523	72.5156	-4.26397
60.8918	-234.523	33.3691	-4.26397
61.0558	-234.523	24.2139	-4.26397
61.2199	-234.523	57.6406	-4.26397
61.3839	-234.523	66.7266	-4.26397
61.5479	-234.523	56.2871	-4.26397
61.712	-234.523	43.8359	-4.26397
61.876	-234.523	43.5039	-4.26397
62.0401	-234.523	49.7168	-4.26397
62.2041	-234.523	33.9629	-4.26397
62.3681	-234.523	42.7148	-4.26397
62.5322	-234.523	57.5078	-4.26397
62.6962	-234.523	33.3574	-4.26397
62.8603	-234.523	30.1104	-4.26397
63.0243	-234.523	57.1211	-4.26397
63.1883	-234.523	53.8574	-4.26397
63.3524	-234.523	77.7344	-4.26397
63.5164	-234.523	39.1621	-4.26397
63.6805	-234.523	60.2695	-4.26397
63.8445	-234.523	45.5996	-4.26397
64.0085	-234.523	33.5273	-4.26397
64.1726	-234.523	45.8984	-4.26397
64.3366	-234.523	45.7168	-4.26397
64.5007	-234.523	51.8008	-4.26397
64.6647	-234.523	63.8145	-4.26397
64.8288	-234.523	27.2383	-4.26397
64.9928	-234.523	33.584	-4.26397
65.1568	-234.523	42.7246	-4.26397
65.3209	-234.523	46.7813	-4.26397
65.4849	-234.523	34.3145	-4.26397
65.6489	-234.523	33.623	-4.26397
65.813	-234.523	39.293	-4.26397
65.977	-234.523	39.4141	-4.26397
66.1411	-234.523	45.5	-4.26397
66.3051	-234.523	36.5742	-4.26397
66.4692	-234.523	55.0879	-4.26397
66.6332	-234.523	36.4863	-4.26397
66.7972	-234.523	51.0742	-4.26397
66.9613	-234.523	47.6113	-4.26397
67.1253	-234.523	62.1191	-4.26397
67.2894	-234.523	58.9297	-4.26397
67.4534	-234.523	29.4375	-4.26397
67.6174	-234.523	59.3047	-4.26397

67.7815	-234.523	50.8281	-4.26397
67.9455	-234.523	44.5566	-4.26397
68.1096	-234.523	41.5195	-4.26397
68.2736	-234.523	35.6621	-4.26397
68.4376	-234.523	38.6973	-4.26397
68.6017	-234.523	54.4609	-4.26397
68.7657	-234.523	61.1035	-4.26397
68.9298	-234.523	46.0664	-4.26397
69.0938	-234.523	39.7051	-4.26397
69.2578	-234.523	33.8066	-4.26397
69.4219	-234.523	45.6445	-4.26397
69.5859	-234.523	36.5703	-4.26397
69.75	-234.523	67.0664	-4.26397
69.914	-234.523	46.0703	-4.26397
70.078	-234.523	49.3105	-4.26397
70.2421	-234.523	39.3613	-4.26397
70.4061	-234.523	15.1177	-4.26397
70.5702	-234.523	72.6055	-4.26397
70.7342	-234.523	54.6504	-4.26397
70.8982	-234.523	48.5527	-4.26397
71.0623	-234.523	39.8008	-4.26397
71.2263	-234.523	52.0176	-4.26397
71.3904	-234.523	66.3438	-4.26397
71.5544	-234.523	50.5898	-4.26397
71.7184	-234.523	38.5547	-4.26397
71.8825	-234.523	47.2852	-4.26397
72.0465	-234.523	47	-4.26397
72.2106	-234.523	67.6367	-4.26397
72.3746	-234.523	53.0469	-4.26397
72.5386	-234.523	65.0938	-4.26397
72.7027	-234.523	80.1055	-4.26397
72.8667	-234.523	56.4375	-4.26397
73.0308	-234.523	35.6992	-4.26397
73.1948	-234.523	65.9492	-4.26397
73.3588	-234.523	68.8242	-4.26397
73.5229	-234.523	57.0918	-4.26397
73.6869	-234.523	68.2539	-4.26397
73.851	-234.523	35.752	-4.26397
74.015	-234.523	41.668	-4.26397
74.1791	-234.523	53.2891	-4.26397
74.3431	-234.523	38.6309	-4.26397
74.5071	-234.523	65.7461	-4.26397
74.6712	-234.523	74.3203	-4.26397
74.8352	-234.523	59.4609	-4.26397
74.9993	-234.523	47.332	-4.26397
75.1633	-234.523	56.1504	-4.26397
75.3273	-234.523	64.9414	-4.26397
75.4914	-234.523	47.6484	-4.26397
75.6554	-234.523	62.5605	-4.26397
75.8195	-234.523	59.1289	-4.26397
75.9835	-234.523	40.9551	-4.26397
76.1475	-234.523	55.1113	-4.26397
76.3116	-234.523	66.4531	-4.26397
76.4756	-234.523	51.7617	-4.26397
76.6397	-234.523	77.6016	-4.26397
76.8037	-234.523	54.5918	-4.26397
76.9677	-234.523	72.4453	-4.26397
77.1318	-234.523	78.5234	-4.26397
77.2958	-234.523	46.4785	-4.26397
77.4599	-234.523	49.377	-4.26397
77.6239	-234.523	105.785	-4.26397
77.7879	-234.523	87.6875	-4.26397
77.952	-234.523	80.2578	-4.26397
78.116	-234.523	59.8184	-4.26397
78.2801	-234.523	62.3867	-4.26397
78.4441	-234.523	98.5	-4.26397
78.6081	-234.523	91.7305	-4.26397
78.7722	-234.523	82.8789	-4.26397

78.9362	-234.523	62.3457	-4.26397
79.1003	-234.523	66.0313	-4.26397
79.2643	-234.523	107.68	-4.26397
79.4283	-234.523	73.1367	-4.26397
79.5924	-234.523	54.5449	-4.26397
79.7564	-234.523	84.9805	-4.26397
79.9205	-234.523	66.6016	-4.26397
80.0845	-234.523	99.8945	-4.26397
80.2485	-234.523	72.9297	-4.26397
80.4126	-234.523	70.0313	-4.26397
80.5766	-234.523	114.105	-4.26397
80.7407	-234.523	77.8516	-4.26397
80.9047	-234.523	35.5918	-4.26397
81.0687	-234.523	88.7148	-4.26397
81.2328	-234.523	82.2734	-4.26397
81.3968	-234.523	108.551	-4.26397
81.5609	-234.523	113.57	-4.26397
81.7249	-234.523	87.7188	-4.26397
81.8889	-234.523	79.1602	-4.26397
82.053	-234.523	75.8359	-4.26397
82.217	-234.523	79.043	-4.26397
82.3811	-234.523	82.4336	-4.26397
82.5451	-234.523	97.5273	-4.26397
82.7092	-234.523	101.227	-4.26397
82.8732	-234.523	101.207	-4.26397
83.0372	-234.523	86.5352	-4.26397
83.2013	-234.523	98.4414	-4.26397
83.3653	-234.523	91.832	-4.26397
83.5293	-234.523	88.5898	-4.26397
83.6934	-234.523	74.5547	-4.26397
83.8574	-234.523	84.1016	-4.26397
84.0215	-234.523	79.2109	-4.26397
84.1855	-234.523	115.645	-4.26397
84.3496	-234.523	115.754	-4.26397
84.5136	-234.523	118.867	-4.26397
84.6776	-234.523	115.359	-4.26397
84.8417	-234.523	110.09	-4.26397
85.0057	-234.523	76.1055	-4.26397
85.1698	-234.523	84.9883	-4.26397
85.3338	-234.523	93.3359	-4.26397
85.4978	-234.523	112.699	-4.26397
85.6619	-234.523	121	-4.26397
85.8259	65.2347	109.246	15.3293
85.99	135.352	120.449	7.38815
86.154	94.3274	111.613	10.6014
86.318	70.5505	143.328	14.1742
86.4821	54.3622	123.254	18.3951
86.6461	42.4594	128.898	23.5519
86.8102	33.9848	102.613	29.4249
86.9742	28.2934	117.582	35.3439
87.1382	23.7095	138.648	42.1772
87.3023	20.6086	188.289	48.5235
87.4663	18.2684	127.457	54.7392
87.6304	16.0246	155	62.404
87.7944	14.7823	159.617	67.6484
87.9584	13.7037	218.344	72.9727
88.1225	12.9815	240.383	77.0328
88.2865	12.5674	235.742	79.571
88.4506	12.3844	234.508	80.7466
88.6146	11.7392	275	85.1847
88.7786	11.2288	273.219	89.0567
88.9427	10.8725	268.031	91.9753
89.1067	10.468	254.289	95.5291
89.2708	10.0828	267.313	99.1787
89.4348	9.76502	231.164	102.406
89.5988	9.44722	264.781	105.851
89.7629	9.05238	250.875	110.468
89.9269	8.86941	268.75	112.747

90.091	8.79237	234.273	113.735
90.255	8.5131	246.688	117.466
90.419	8.44568	232.148	118.404
90.5831	8.08937	261.094	123.619
90.7471	7.87751	228.516	126.944
90.9112	8.099	269.703	123.472
91.0752	8.06048	245.648	124.062
91.2392	7.87751	282.734	126.944
91.4033	7.71379	266.047	129.638
91.5673	7.65601	227.617	130.616
91.7314	7.4923	236.078	133.47
91.8954	7.63675	222.133	130.946
92.0595	7.41526	322.781	134.857
92.2235	7.44415	305.969	134.334
92.3875	7.45378	248.016	134.16
92.5516	7.48267	271.734	133.642
92.7156	7.19377	310.797	139.009
92.8796	7.12635	261	140.324
93.0437	7.00116	241.336	142.833
93.2077	7.14561	315.453	139.946
93.3718	6.97227	312.547	143.425
93.5358	6.91449	306.109	144.624
93.6999	6.90486	290.875	144.826
93.8639	6.85671	269.813	145.843
94.0279	6.97227	246.094	143.425
94.192	6.84708	233.977	146.048
94.356	7.04931	307.406	141.858
94.5201	6.68337	250.766	149.625
94.6841	6.83745	278.281	146.253
94.8481	6.90486	279.266	144.826
95.0122	6.76041	270.797	147.92
95.1762	6.66411	280.813	150.058
95.3403	6.49076	263.813	154.065
95.5043	6.54854	285.469	152.706
95.6683	6.65448	284.594	150.275
95.8324	6.83745	253.664	146.253
95.9964	6.66411	314.734	150.058
96.3245	6.5967	246.398	151.591
96.4885	6.64485	294.266	150.493
96.6526	6.49076	263.297	154.065
96.8166	6.51965	307.688	153.382
96.9807	6.56781	271.547	152.258
97.1447	6.42335	287.828	155.682
97.3087	6.33668	280.203	157.811
97.4728	6.46187	289.797	154.754
97.6368	6.62559	291.109	150.93
97.8009	6.51965	254.172	153.382
97.9649	6.54854	227.406	152.706
98.1289	6.45224	269.953	154.985
98.293	6.4715	268.547	154.524
98.457	6.33668	270.531	157.811
98.6211	6.49076	254.32	154.065
98.7851	6.50039	273.609	153.837
98.9491	6.39446	277.828	156.385
99.1132	6.36557	288.578	157.095
99.2772	6.32705	289.844	158.052
99.4413	6.51965	306.547	153.382
99.6053	6.46187	270.078	154.754
99.7693	6.35594	233.875	157.333
99.9334	6.40409	278.641	156.15
100.097	6.40409	300.484	156.15
100.261	6.3752	282.094	156.858
100.426	6.35594	248.086	157.333
100.59	6.33668	263.641	157.811
100.754	6.32705	304.781	158.052
100.918	6.40409	266.906	156.15
101.082	6.24038	277.469	160.247
101.246	6.2789	314.422	159.264

101.41	6.21149	254.969	160.992
101.574	6.32705	276.438	158.052
101.738	6.21149	271.922	160.992
101.902	6.20186	307.141	161.242
102.066	6.32705	308.219	158.052
102.23	6.46187	252.531	154.754
102.394	6.14408	232.859	162.758
102.558	6.1826	263.844	161.744
102.722	6.46187	233.219	154.754
102.886	6.33668	282.984	157.811
103.05	6.42335	243.867	155.682
103.214	6.26927	297.313	159.508
103.378	6.24038	288.25	160.247
103.542	6.1826	277.109	161.744
103.706	6.21149	281.078	160.992
103.87	6.24038	272.531	160.247
104.034	6.26927	288.625	159.508
104.198	6.15371	249.625	162.504
104.362	6.04778	331.703	165.35
104.527	6.0863	268.906	164.303
104.691	6.11519	296.516	163.527
104.855	6.11519	284.875	163.527
105.019	6.05741	299.547	165.087
105.183	6.21149	311.391	160.992
105.347	6.25964	288.5	159.754
105.511	6.29816	305.953	158.777
105.675	6.35594	257.438	157.333
105.839	6.33668	266.328	157.811
106.003	6.26927	298.891	159.508
106.167	6.21149	243.398	160.992
106.331	6.21149	247.75	160.992
106.495	6.14408	268.188	162.758
106.659	6.36557	282.688	157.095
106.823	6.5967	290.734	151.591
106.987	5.94185	259.781	168.298
107.151	3.64024	254.641	274.707
107.315	5.85517	266.563	170.789
107.479	7.89677	255.57	126.634
107.643	7.45378	279.266	134.16
107.807	7.01079	322.172	142.637
107.971	11.0747	271.625	90.2958
108.135	8.53236	314.953	117.201
108.299	6.32705	308.938	158.052
108.463	6.74115	285.438	148.343
108.628	6.72189	235.891	148.768
108.792	6.03815	267.609	165.614
108.956	6.17297	290.5	161.997
109.12	6.33668	283.422	157.811
109.284	6.33668	297.266	157.811
109.448	6.20186	262.438	161.242
109.612	6.33668	249.125	157.811
109.776	6.17297	293.875	161.997
109.94	6.25964	277.297	159.754
110.104	6.13445	263.344	163.014
110.268	6.04778	257.281	165.35
110.432	6.10556	287.594	163.785
110.596	6.20186	310.969	161.242
110.76	6.20186	287.828	161.242
110.924	6.20186	256.156	161.242
111.088	6.0863	300.109	164.303
111.252	6.11519	261.953	163.527
111.416	6.15371	272.234	162.504
111.58	6.33668	247.188	157.811
111.744	6.4715	297.906	154.524
111.908	6.49076	234.859	154.065
112.072	6.4715	282.453	154.524
112.236	6.49076	331.203	154.065
112.4	6.24038	307.844	160.247

112.564	6.04778	277.703	165.35
112.729	6.21149	227.531	160.992
112.893	6.30779	292.672	158.534
113.057	6.24038	281.156	160.247
113.221	6.14408	253.695	162.758
113.385	6.33668	284.953	157.811
113.549	6.29816	313.453	158.777
113.713	6.25964	272.156	159.754
113.877	6.26927	256.266	159.508
114.041	6.32705	302.875	158.052
114.205	6.29816	249.602	158.777
114.369	6.2789	228.641	159.264
114.533	6.11519	276.484	163.527
114.697	6.10556	271.922	163.785
114.861	6.24038	261.891	160.247
115.025	6.29816	279.109	158.777
115.189	6.24038	313.781	160.247
115.353	6.46187	299.094	154.754
115.517	6.45224	281.781	154.985
115.681	6.32705	233.039	158.052
115.845	6.26927	297.094	159.508
116.009	6.17297	338.5	161.997
116.173	6.24038	282.328	160.247
116.337	6.25964	314.563	159.754
116.501	6.3752	229.719	156.858
116.666	6.51965	282.516	153.382
116.83	6.39446	301.328	156.385
116.994	6.25964	242.797	159.754
117.158	6.25964	267.922	159.754
117.322	6.21149	292.094	160.992
117.486	6.15371	258.391	162.504
117.65	6.0863	276.359	164.303
117.814	6.23075	327.078	160.494
117.978	6.42335	242.172	155.682
118.142	6.46187	252.172	154.754
118.306	6.3752	262.469	156.858
118.47	6.36557	276.688	157.095
118.634	6.25964	267.766	159.754
118.798	6.23075	287	160.494
118.962	6.29816	268.016	158.777
119.126	6.25964	271.141	159.754
119.29	6.26927	283.75	159.508
119.454	6.49076	279.375	154.065
119.618	6.52928	242.789	153.156
119.782	6.54854	229.531	152.706
119.946	6.64485	273.953	150.493
120.11	6.56781	258.75	152.258
120.274	6.49076	266.609	154.065
120.438	6.36557	273.453	157.095
120.602	6.3752	269.953	156.858
120.767	6.45224	294.969	154.985
120.931	6.40409	300.5	156.15
121.095	6.40409	319.781	156.15
121.259	6.49076	336.375	154.065
121.423	6.32705	269.203	158.052
121.587	6.35594	277.453	157.333
121.751	6.4715	300.938	154.524
121.915	6.3752	312.406	156.858
122.079	6.54854	316.547	152.706
122.243	6.50039	314.281	153.837
122.407	6.26927	236.383	159.508
122.571	6.26927	247.867	159.508
122.735	6.4715	283	154.524
122.899	6.13445	241.164	163.014
123.063	6.25964	303.938	159.754
123.227	6.29816	300.672	158.777
123.391	6.11519	270.672	163.527
123.555	6.29816	253.602	158.777

123.719	6.13445	346.359	163.014
123.883	6.30779	270.906	158.534
124.047	6.36557	221.75	157.095
124.211	6.23075	245.891	160.494
124.375	6.20186	303.219	161.242
124.539	6.32705	277.5	158.052
124.703	6.33668	245.047	157.811
124.868	6.40409	314.156	156.15
125.032	6.43298	254.008	155.449
125.196	6.40409	279.094	156.15
125.36	6.33668	291.641	157.811
125.524	6.26927	272.797	159.508
125.688	6.14408	264.484	162.758
125.852	6.26927	229.297	159.508
126.016	6.3752	271.266	156.858
126.18	6.68337	275.734	149.625
126.344	6.61596	331.422	151.15
126.508	6.33668	327.625	157.811
126.672	6.40409	308	156.15
126.836	6.2789	257.172	159.264
127	6.39446	315.219	156.385
127.164	6.24038	269.313	160.247
127.328	6.4715	252.867	154.524
127.492	6.4715	252.297	154.524
127.656	6.55818	371.313	152.481
127.82	6.51965	263.922	153.382
127.984	6.62559	250.367	150.93
128.148	6.46187	286.25	154.754
128.312	6.55818	282.141	152.481
128.476	6.51965	269.938	153.382
128.64	6.61596	248.555	151.15
128.804	6.71226	309.125	148.981
128.969	6.5967	315.141	151.591
129.133	6.77967	268.203	147.5
129.297	6.65448	273.609	150.275
129.461	6.7893	240.617	147.291
129.625	6.85671	256.969	145.843
129.789	6.83745	217.328	146.253
129.953	6.58707	308.516	151.813
130.117	6.74115	280.609	148.343
130.281	6.87597	259.563	145.434
130.445	6.76041	292.922	147.92
130.609	6.56781	340.719	152.258
130.773	6.7893	291.172	147.291
130.937	6.93375	248.586	144.222
131.101	7.09746	306.547	140.895
131.265	7.0782	275.156	141.279
131.429	7.0782	290.656	141.279
131.593	7.26118	291.547	137.719
131.757	7.26118	267.953	137.719
131.921	7.19377	218.883	139.009
132.085	7.27081	207.484	137.536
132.249	7.54045	293.469	132.618
132.413	7.64638	236.648	130.781
132.577	8.0027	300.359	124.958
132.741	7.99307	232.172	125.108
132.906	8.11826	258.031	123.179
133.07	8.26271	267.969	121.026
133.234	8.2916	269.734	120.604
133.398	8.34938	335.188	119.769
133.562	8.47457	317.578	118
133.726	8.74422	265.531	114.361
133.89	8.74422	319.891	114.361
134.054	9.17758	313.922	108.961
134.218	9.44722	264.156	105.851
134.382	9.85169	263.219	101.505
134.546	10.0058	296.625	99.9423
134.71	10.2947	245.359	97.1376

134.874	10.6221	280.156	94.1434
135.038	10.8243	255.188	92.3845
135.202	10.9977	290.188	90.9283
135.366	11.1614	271.391	89.5946
135.53	11.0747	258.375	90.2958
135.694	11.0362	334.063	90.6109
135.858	11.1325	293.469	89.8271
136.022	11.171	270.016	89.5174
136.186	11.1132	254.398	89.9828
136.35	10.9977	299.438	90.9283
136.514	10.6799	279.484	93.634
136.678	10.5258	247.68	95.0047
136.842	10.2658	304.625	97.411
137.007	9.90947	270	100.914
137.171	9.79391	280.422	102.104
137.335	9.81317	249.703	101.904
137.499	9.66871	273.188	103.426
137.663	9.68797	260.656	103.221
137.827	9.49537	287.141	105.314
137.991	9.54352	312.313	104.783
138.155	9.35092	265.234	106.941
138.319	9.02349	210.945	110.822
138.483	9.0909	238.219	110
138.647	8.8983	177.93	112.381
138.811	8.93682	206.555	111.897
138.975	8.88867	213.898	112.503
139.139	9.06201	210.836	110.351
139.303	9.02349	227.344	110.822
139.467	9.17758	212.406	108.961
139.631	9.01386	208.453	110.94
139.795	9.39907	207.805	106.394
139.959	9.49537	173.508	105.314
140.123	9.43759	215.531	105.959
140.287	9.39907	224.102	106.394
140.451	9.6013	174.219	104.153
140.615	9.76502	182.578	102.406
140.779	9.47611	239.352	105.529
140.943	9.20647	211	108.619
141.108	9.14869	222.609	109.305
141.272	9.2161	198.227	108.506
141.436	9.34129	196.227	107.052
141.6	9.63019	233.586	103.84
141.764	9.39907	245.68	106.394
141.928	9.44722	224.297	105.851
142.092	9.57241	219.508	104.467
142.256	9.56278	232.422	104.572
142.584	9.2161	258.203	108.506
142.748	8.86941	187.633	112.747
142.912	8.92719	219.633	112.017
143.076	8.82126	314.844	113.362
143.24	8.802	197.031	113.611
143.404	8.58051	169.727	116.543
143.568	8.73459	237.68	114.487
143.732	8.76348	198.563	114.11
143.896	8.66718	213.352	115.378
144.06	8.67681	266.516	115.25
144.224	8.37827	261.125	119.356
144.388	8.55162	234.328	116.937
144.552	8.57088	251.383	116.674
144.716	8.34938	249.188	119.769
144.88	8.11826	289.703	123.179
145.044	7.89677	220.672	126.634
145.209	7.97381	206.875	125.411
145.373	8.12789	229.008	123.033
145.537	8.40716	245.133	118.946
145.701	8.11826	249.102	123.179
145.865	8.26271	291.563	121.026
146.029	7.87751	237.633	126.944

146.193	7.74268	282.375	129.154
146.357	7.73305	279.453	129.315
146.521	7.93529	292.688	126.019
146.685	7.83899	237.109	127.568
146.849	7.6849	294.484	130.125
147.013	7.55008	236.875	132.449
147.177	7.55008	213.273	132.449
147.341	7.34785	246.906	136.094
147.505	7.26118	241.805	137.719
147.669	7.10709	284.453	140.704
147.833	7.23229	287.703	138.269
147.997	7.31896	218.633	136.631
148.161	7.25155	281.578	137.902
148.325	7.38637	274.969	135.385
148.489	7.1745	245.258	139.382
148.653	7.27081	210.977	137.536
148.817	7.31896	244.57	136.631
148.981	7.10709	229.711	140.704
149.145	6.9819	259.344	143.227
149.31	7.19377	195.141	139.009
149.474	7.2997	298.813	136.992
149.638	7.29007	232.719	137.173
149.802	7.26118	217.57	137.719
149.966	7.42489	240.375	134.682
150.13	7.31896	217.773	136.631
150.294	7.29007	301.359	137.173
150.458	7.27081	287	137.536
150.622	7.23229	302.469	138.269
150.786	7.32859	252.063	136.452
150.95	7.32859	289.281	136.452
151.114	7.45378	252.016	134.16
151.278	7.4923	216.195	133.47
151.442	7.27081	276.609	137.536
151.606	7.35748	250.711	135.916
151.77	7.44415	259.125	134.334
151.934	7.55008	246.898	132.449
152.098	7.55971	237.055	132.28
152.262	7.81009	285.953	128.039
152.426	7.71379	258.375	129.638
152.59	7.92566	302.031	126.173
152.754	8.099	231.367	123.472
152.918	8.22419	248.875	121.593
153.082	8.06048	245.805	124.062
153.247	8.11826	232.625	123.179
153.411	8.11826	252.789	123.179
153.575	8.31086	184.5	120.324
153.739	8.13752	254.836	122.888
153.903	8.48421	204.992	117.866
154.067	8.48421	258.5	117.866
154.231	8.66718	270.797	115.378
154.395	8.54199	229.195	117.069
154.559	8.82126	199.734	113.362
154.723	8.67681	268.484	115.25
154.887	8.64792	221.359	115.635
155.051	8.73459	230.203	114.487
155.215	8.85978	260.281	112.87
155.379	8.93682	269.078	111.897
155.543	9.34129	304.672	107.052
155.707	9.23536	285.156	108.28
155.871	9.15832	281.344	109.19
156.035	9.3124	295.953	107.384
156.199	9.03312	285.172	110.704
156.363	8.88867	246.328	112.503
156.527	8.47457	298.094	118
156.691	8.40716	233.844	118.946
156.855	8.37827	291.984	119.356
157.019	8.26271	246.008	121.026
157.183	8.25308	241.555	121.167

157.348	8.06048	263.5	124.062
157.512	8.13752	233.813	122.888
157.676	8.02196	245.578	124.658
157.84	7.87751	274.5	126.944
158.004	7.73305	238.703	129.315
158.168	7.89677	278.922	126.634
158.332	7.67527	266.438	130.289
158.496	7.34785	255.758	136.094
158.66	7.29007	348.266	137.173
158.824	7.4923	254.523	133.47
158.988	7.41526	205.125	134.857
159.152	7.73305	277.859	129.315
159.316	7.71379	247.109	129.638
159.48	7.65601	254.719	130.616
159.644	7.84862	251.406	127.411
159.808	7.63675	263.609	130.946
159.972	7.46341	278.125	133.987
160.136	7.2997	204.977	136.992
160.3	7.32859	277.5	136.452
160.464	7.2997	201.727	136.992
160.628	7.2034	256.188	138.823
160.792	7.396	278.922	135.208
160.956	7.34785	290.75	136.094
161.12	7.36711	256	135.738
161.284	7.14561	268.797	139.946
161.449	7.00116	274.984	142.833
161.613	6.93375	316.141	144.222
161.777	7.19377	276.984	139.009
161.941	7.26118	278.766	137.719
162.105	7.396	322.359	135.208
162.269	7.2997	272.438	136.992
162.433	7.57897	232.828	131.944
162.597	7.55971	237.219	132.28
162.761	7.74268	286.656	129.154
162.925	7.74268	256.234	129.154
163.089	7.77157	255.742	128.674
163.253	7.61749	244.875	131.277
163.417	7.65601	262.391	130.616
163.581	7.83899	260.656	127.568
163.745	7.84862	211.719	127.411
163.909	8.11826	245.828	123.179
164.073	8.11826	243.492	123.179
164.237	8.31086	231.227	120.324
164.401	8.64792	235.547	115.635
164.565	8.76348	226.5	114.11
164.729	8.9946	235.977	111.178
164.893	9.12943	232.125	109.536
165.057	9.14869	217.875	109.305
165.221	9.505	239.656	105.208
165.385	9.97688	239.078	100.232
165.55	9.46648	225.43	105.636
165.714	8.85978	273.484	112.87
165.878	8.79237	190.875	113.735
166.042	9.85169	212.945	101.505
166.206	10.2754	189.086	97.3197
166.37	10.3428	242.336	96.6854
166.534	10.651	233.969	93.888
166.698	10.7858	269.219	92.7144
166.862	9.27388	218.344	107.83
167.026	7.25155	261.578	137.902
167.19	7.03968	267.609	142.052
167.354	6.11519	248.453	163.527
167.518	5.69146	213.234	175.702
167.682	6.33668	230.781	157.811
167.846	7.32859	242.258	136.452
168.01	6.77967	214.805	147.5
168.174	6.55818	243.906	152.481
168.338	6.62559	229.555	150.93

168.502	6.21149	303.594	160.992
168.666	4.70919	178.883	212.351
168.83	3.57283	203.133	279.89
168.994	2.13794	154.102	467.741
169.158	0.260057	195.016	3845.31
169.322	-0.895561	227.383	-1116.62
169.486	0.693414	206.641	1442.14
169.651	2.74464	203.281	364.347
169.815	3.96766	122.945	252.037
169.979	5.12328	160.234	195.187
170.143	6.58707	138.281	151.813
170.307	7.99307	140.914	125.108
170.471	7.99307	164.719	125.108
170.635	7.64638	153.016	130.781
170.799	6.97227	112.188	143.425
170.963	5.94185	144.047	168.298
171.127	4.61288	151.711	216.784
171.291	4.02545	115.398	248.42
171.455	4.42028	162.617	226.23
171.619	4.92105	143.398	203.209
171.783	5.62405	173.328	177.808
171.947	6.23075	149.484	160.494
172.111	6.72189	155.313	148.768
172.275	6.7893	149.367	147.291
172.439	7.36711	121.512	135.738
172.603	7.67527	165.156	130.289
172.767	8.3879	136.117	119.219
172.931	8.74422	141.914	114.361
173.095	9.37018	141.109	106.722
173.259	9.81317	142.398	101.904
173.423	10.0154	154.656	99.8462
173.588	10.0828	153.922	99.1787
173.752	9.78428	190.234	102.205
173.916	9.76502	183.852	102.406
174.08	9.83243	159.609	101.704
174.244	9.4087	152.516	106.285
174.408	9.2161	151.977	108.506
174.572	9.6976	137.125	103.118
174.736	9.8228	118.566	101.804
174.9	9.54352	176.039	104.783
175.064	9.75538	153.156	102.507
175.228	9.97688	151.305	100.232
175.392	9.57241	124.602	104.467
175.556	9.79391	135.828	102.104
175.72	9.83243	146.211	101.704
175.884	9.72649	152.07	102.812
176.048	9.66871	147.914	103.426
176.212	9.56278	131.281	104.572
176.376	9.505	167.094	105.208
176.54	9.52426	175.984	104.995
176.704	9.47611	188	105.529
176.868	9.15832	123.926	109.19
177.032	9.12943	135.75	109.536
177.196	9.4087	134.578	106.285
177.36	9.44722	157.055	105.851
177.524	9.72649	148.484	102.812
177.689	10.1695	140.398	98.3334
177.853	9.78428	180.961	102.205
178.017	9.39907	129.523	106.394
178.181	8.91756	127.176	112.138
178.345	8.802	165.164	113.611
178.509	8.91756	176.797	112.138
178.673	8.98497	125.094	111.297
178.837	8.76348	154.469	114.11
179.001	8.9946	128.836	111.178
179.165	8.62866	157.078	115.893
179.329	8.1953	126.586	122.021
179.493	8.25308	129.555	121.167

179.657	8.55162	141.477	116.937
179.821	8.7057	186.281	114.867
179.985	8.69607	156.594	114.994
180.149	8.83089	115.648	113.239
180.313	8.53236	121.566	117.201
180.477	8.37827	180.164	119.356
180.641	8.33975	131.828	119.908
180.805	8.26271	141.797	121.026
180.969	8.07011	164.328	123.914
181.133	8.54199	155.695	117.069
181.297	8.45531	135.688	118.269
181.461	8.55162	140.898	116.937
181.625	8.53236	150.164	117.201
181.79	8.37827	149.555	119.356
181.954	7.82935	155.727	127.724
182.118	7.64638	126.891	130.781
182.282	7.61749	127.281	131.277
182.446	7.5886	127.359	131.777
182.61	7.55971	98.5156	132.28
182.774	7.5886	121.906	131.777
182.938	7.5886	169.016	131.777
183.102	7.70416	148.266	129.8
183.266	7.6849	175.234	130.125
183.43	7.57897	204.438	131.944
183.594	7.70416	215.727	129.8
183.758	7.60786	178.711	131.443
183.922	7.57897	183.148	131.944
184.086	7.55971	189.109	132.28
184.25	7.80046	212.547	128.197
184.414	7.55008	243.703	132.449
184.578	7.4923	212.781	133.47
184.742	7.34785	197.102	136.094
184.906	7.31896	217.359	136.631
185.07	7.35748	191.664	135.916
185.234	7.42489	230.641	134.682
185.398	7.45378	215.227	134.16
185.562	7.45378	158.742	134.16
185.726	7.35748	253.289	135.916
185.891	7.41526	200.516	134.857
186.055	7.48267	204.75	133.642
186.219	7.396	222.547	135.208
186.383	7.32859	247.859	136.452
186.547	7.396	170.211	135.208
186.711	7.29007	196.484	137.173
186.875	7.48267	162.273	133.642
187.039	7.2997	230.289	136.992
187.203	7.5886	221.773	131.777
187.367	7.55971	200.805	132.28
187.531	7.36711	224.281	135.738
187.695	7.34785	200.43	136.094
187.859	7.32859	194.844	136.452
188.023	7.2034	225.898	138.823
188.187	7.22266	259.656	138.453
188.351	7.42489	174.391	134.682
188.515	7.38637	219.617	135.385
188.679	7.34785	222.5	136.094
188.843	7.35748	228.281	135.916
189.007	7.29007	213.25	137.173
189.171	7.31896	193.5	136.631
189.335	7.2034	233.25	138.823
189.499	7.42489	215.922	134.682
189.663	7.44415	214.766	134.334
189.828	7.32859	191.531	136.452
189.992	7.14561	201.688	139.946
190.156	7.2997	205.164	136.992
190.32	7.1745	199.836	139.382
190.484	7.04931	205.188	141.858
190.648	7.19377	179.492	139.009

190.812	7.23229	208.953	138.269
190.976	7.0782	225.141	141.279
191.14	7.00116	284.219	142.833
191.304	7.13598	206.352	140.135
191.468	6.9819	180	143.227
191.632	6.75078	203.734	148.131
191.796	6.81819	235.063	146.667
191.96	6.84708	191.898	146.048
192.124	6.83745	208.953	146.253
192.288	6.81819	200.695	146.667
192.452	6.91449	189.094	144.624
192.616	6.87597	225.227	145.434
192.78	6.76041	202.398	147.92
192.944	6.87597	200.297	145.434
193.108	6.8856	192.234	145.231
193.272	6.81819	200.969	146.667
193.436	6.71226	257.484	148.981
193.6	6.693	229.227	149.41
193.764	6.83745	178.727	146.253
193.929	7.13598	226.078	140.135
194.093	7.12635	194.156	140.324
194.257	6.8856	208.617	145.231
194.421	7.1745	181.836	139.382
194.585	7.14561	238.766	139.946
194.749	7.04931	210.781	141.858
194.913	7.03968	228.203	142.052
195.077	7.12635	199.195	140.324
195.241	7.04931	245.539	141.858
195.405	6.87597	236.594	145.434
195.569	7.19377	184.555	139.009
195.733	7.34785	221.023	136.094
195.897	7.0782	202.711	141.279
196.061	7.22266	261.172	138.453
196.225	7.35748	203.578	135.916
196.389	7.09746	182.906	140.895
196.553	7.31896	219.586	136.631
196.717	7.26118	246.953	137.719
196.881	7.26118	234.508	137.719
197.045	7.06857	207.359	141.471
197.209	7.13598	213.906	140.135
197.373	7.38637	185.484	135.385
197.537	7.34785	250.867	136.094
197.701	7.2034	201.656	138.823
197.865	7.13598	219.234	140.135
198.03	7.25155	211.148	137.902
198.194	7.36711	220.547	135.738
198.358	7.03968	161.648	142.052
198.522	7.23229	230.797	138.269
198.686	7.06857	201.609	141.471
198.85	7.19377	243.516	139.009
199.014	6.83745	236.883	146.253
199.178	6.94338	219.391	144.022
199.342	6.90486	205.961	144.826
199.506	7.27081	245.883	137.536
199.67	7.12635	187.563	140.324
199.834	7.13598	211.031	140.135
199.998	7.03005	173.781	142.246
200.162	7.29007	223.102	137.173
200.326	7.22266	197.656	138.453
200.49	6.9819	216.891	143.227
200.654	6.90486	176.266	144.826
200.818	7.13598	208.586	140.135
200.982	7.0782	199.211	141.279
201.146	6.85671	171.758	145.843
201.31	6.71226	237.352	148.981
201.474	7.03968	228.047	142.052
201.638	7.22266	227.945	138.453
201.802	6.83745	202.258	146.253

201.966	6.693	256.922	149.41
202.131	6.66411	195.766	150.058
202.295	6.54854	182.938	152.706
202.459	6.77967	214.711	147.5
202.623	6.97227	208.172	143.425
202.787	6.81819	226.047	146.667
202.951	6.693	192.492	149.41
203.115	6.61596	214.789	151.15
203.279	6.83745	174.367	146.253
203.443	6.9819	212.242	143.227
203.607	6.77967	223.563	147.5
203.771	6.84708	197.258	146.048
203.935	6.8856	199.414	145.231
204.099	6.90486	179.398	144.826
204.263	6.95301	260.063	143.823
204.427	6.85671	205.781	145.843
204.591	6.83745	170.203	146.253
204.755	6.7893	205.398	147.291
204.919	6.72189	254.328	148.768
205.083	6.75078	188.016	148.131
205.247	6.85671	159.086	145.843
205.411	6.72189	205.961	148.768
205.575	6.84708	211.719	146.048
205.739	6.61596	207.547	151.15
205.903	6.61596	206.773	151.15
206.067	6.7893	151.766	147.291
206.232	6.83745	196.219	146.253
206.396	6.90486	194.25	144.826
206.56	6.93375	237.086	144.222
206.724	6.8856	198.391	145.231
206.888	6.93375	172.211	144.222
207.052	6.94338	235.141	144.022
207.216	6.62559	163.422	150.93
207.38	6.84708	174.883	146.048
207.544	7.03968	212.578	142.052
207.708	6.95301	184.547	143.823
207.872	7.01079	194.719	142.637
208.036	6.90486	239.836	144.826
208.2	6.81819	181.648	146.667
208.364	6.81819	161.164	146.667
208.528	6.81819	216.297	146.667
208.692	6.83745	153.492	146.253
208.856	7.03968	181.734	142.052
209.02	7.03005	203.078	142.246
209.184	7.41526	218.508	134.857
209.348	7.34785	207.703	136.094
209.512	7.35748	218.859	135.916
209.676	7.16487	181.773	139.57
209.84	7.01079	127.523	142.637
210.004	7.10709	191.367	140.704
210.169	6.80856	211.984	146.874
210.333	6.74115	196.625	148.343
210.497	6.81819	142.227	146.667
210.661	6.81819	228.359	146.667
210.825	7.03968	184.398	142.052
210.989	7.22266	168.453	138.453
211.153	7.10709	209.977	140.704
211.317	7.25155	240.828	137.902
211.481	7.12635	200.93	140.324
211.645	7.13598	180.906	140.135
211.809	6.93375	210.711	144.222
211.973	6.93375	194.508	144.222
212.137	6.95301	235.453	143.823
212.301	6.94338	201.688	144.022
212.465	6.84708	219.203	146.048
212.629	7.0782	219.766	141.279
212.793	7.06857	219.547	141.471
212.957	6.95301	199.656	143.823

213.121	7.09746	188.898	140.895
213.285	7.09746	183.164	140.895
213.449	7.01079	171.117	142.637
213.613	6.7893	222.242	147.291
213.777	6.90486	184.969	144.826
213.941	7.0782	158.492	141.279
214.105	7.09746	173.672	140.895
214.27	6.80856	240.57	146.874
214.434	7.01079	242.406	142.637
214.598	7.14561	232.156	139.946
214.762	7.06857	171.195	141.471
214.926	6.7893	148.227	147.291
215.09	6.8856	172.547	145.231
215.254	7.25155	250.063	137.902
215.418	7.23229	161.75	138.269
215.582	7.2997	217.539	136.992
215.746	7.29007	189.063	137.173
215.91	7.396	200.773	135.208
216.074	7.10709	216.352	140.704
216.238	7.36711	201.758	135.738
216.402	7.52119	180.891	132.958
216.566	7.29007	213.406	137.173
216.73	7.13598	167.57	140.135
216.894	7.29007	235.898	137.173
217.058	7.19377	225.352	139.009
217.222	6.97227	162.648	143.425
217.386	6.93375	216.445	144.222
217.55	7.04931	205.188	141.858
217.714	7.22266	200.016	138.453
217.878	7.31896	176.203	136.631
218.042	7.25155	202.141	137.902
218.206	7.23229	198.742	138.269
218.371	7.1745	203.805	139.382
218.535	7.23229	182.125	138.269
218.699	7.06857	212.211	141.471
218.863	7.14561	163.031	139.946
219.027	7.12635	188.305	140.324
219.191	7.12635	177.492	140.324
219.355	7.2997	185.664	136.992
219.519	7.27081	182.875	137.536
219.683	7.09746	198.898	140.895
219.847	7.25155	214.406	137.902
220.011	7.14561	218.109	139.946
220.175	7.34785	238.156	136.094
220.339	6.83745	198.352	146.253
220.503	7.06857	216.164	141.471
220.667	7.10709	201.391	140.704
220.831	7.25155	217.977	137.902
220.995	7.31896	213.883	136.631
221.159	7.77157	180.648	128.674
221.323	7.48267	201.477	133.642
221.487	7.60786	176.492	131.443
221.651	7.2997	205.227	136.992
221.815	7.396	217.617	135.208
221.979	7.38637	211.648	135.385
222.143	7.29007	211.469	137.173
222.307	7.27081	208.563	137.536
222.472	7.03968	201.266	142.052
222.636	6.9819	215.797	143.227
222.8	7.2034	209.367	138.823
222.964	7.25155	163.961	137.902
223.128	7.38637	229.148	135.385
223.292	7.25155	156.109	137.902
223.456	7.25155	211.484	137.902
223.62	7.0782	162.266	141.279
223.784	7.04931	211.211	141.858
223.948	7.06857	185.141	141.471
224.112	7.13598	198.375	140.135

224.276	7.00116	186.641	142.833
224.44	7.00116	194.281	142.833
224.604	6.91449	170.672	144.624
224.768	7.2034	188.383	138.823
224.932	6.9819	212.578	143.227
225.096	6.90486	177.172	144.826
225.26	6.95301	163.68	143.823
225.424	7.1745	204.422	139.382
225.588	7.00116	186.188	142.833
225.752	6.9819	196.055	143.227
225.916	6.85671	192.047	145.843
226.08	6.81819	222.781	146.667
226.244	6.87597	188.414	145.434
226.409	6.97227	159.047	143.425
226.573	7.03968	251.078	142.052
226.737	6.9819	176.203	143.227
226.901	6.71226	149.719	148.981
227.065	6.87597	218.023	145.434
227.229	7.04931	167.43	141.858
227.393	6.9819	184.008	143.227
227.557	6.9819	197.141	143.227
227.721	6.93375	234.57	144.222
227.885	6.94338	155.711	144.022
228.049	6.85671	179.828	145.843
228.213	6.84708	180.195	146.048
228.377	6.97227	206.508	143.425
228.541	7.03005	226.906	142.246
228.705	7.06857	205.008	141.471
228.869	7.01079	195.898	142.637
229.033	7.0782	194.117	141.279
229.197	6.7893	202.742	147.291
229.361	6.9819	259.141	143.227
229.525	7.0782	193.219	141.279
229.689	7.14561	175.141	139.946
229.853	7.31896	190.703	136.631
230.017	7.19377	212.914	139.009
230.181	7.01079	191.43	142.637
230.345	7.04931	189.859	141.858
230.51	7.19377	169.875	139.009
230.674	7.2034	199.492	138.823
230.838	7.09746	244.633	140.895
231.002	7.12635	207.57	140.324
231.166	7.06857	221.414	141.471
231.33	7.00116	187.289	142.833
231.494	7.0782	166.266	141.279
231.658	7.03968	195.742	142.052
231.822	7.10709	191.008	140.704
231.986	7.22266	190.648	138.453
232.15	7.16487	196.664	139.57
232.314	7.14561	173.516	139.946
232.478	6.97227	147.547	143.425
232.642	6.80856	205.75	146.874
232.806	6.95301	188.125	143.823
232.97	6.90486	200.57	144.826
233.134	6.93375	227.508	144.222
233.298	6.83745	219.438	146.253
233.462	6.8856	211.359	145.231
233.626	6.93375	167.266	144.222
233.79	6.9819	170.125	143.227
233.954	7.03005	180.734	142.246
234.118	6.94338	184.023	144.022
234.282	6.72189	240.43	148.768
234.446	6.71226	210.172	148.981
234.611	7.01079	189.117	142.637
234.775	6.9819	196.25	143.227
234.939	6.95301	183.383	143.823
235.103	7.0782	217.43	141.279
235.267	7.13598	228.445	140.135

235.431	7.03968	202.195	142.052
235.595	7.01079	264.688	142.637
235.759	6.80856	194.016	146.874
235.923	6.77967	225.789	147.5
236.087	6.71226	219.484	148.981
236.251	6.8856	179.641	145.231
236.415	6.91449	127.121	144.624
236.579	6.95301	156.141	143.823
236.743	6.83745	238.586	146.253
236.907	6.58707	226.656	151.813
237.071	6.72189	241.164	148.768
237.235	6.77967	156.969	147.5
237.399	6.693	203.266	149.41
237.563	6.84708	217.82	146.048
237.727	6.87597	193.172	145.434
237.891	6.95301	186.734	143.823
238.055	6.74115	185.031	148.343
238.219	6.74115	212.266	148.343
238.383	6.76041	176.156	147.92
238.547	6.66411	210.742	150.058
238.712	6.76041	190.359	147.92
238.876	6.87597	246.688	145.434
239.04	6.84708	222.672	146.048
239.204	6.94338	214.586	144.022
239.368	6.97227	210.141	143.425
239.532	6.85671	186.75	145.843
239.696	7.0782	176.352	141.279
239.86	7.14561	202.094	139.946
240.024	7.26118	193.25	137.719
240.188	7.41526	202.141	134.857
240.352	7.32859	193.234	136.452
240.516	7.00116	205.625	142.833
240.68	7.16487	161.984	139.57
240.844	7.26118	187.836	137.719
241.008	6.93375	156.305	144.222
241.172	7.04931	197.656	141.858
241.336	7.00116	209.438	142.833
241.5	6.95301	209.344	143.823
241.664	7.27081	198.297	137.536
241.828	7.01079	237.445	142.637
241.992	7.26118	191.313	137.719
242.156	7.29007	238.484	137.173
242.32	7.10709	201.836	140.704
242.484	7.14561	182.063	139.946
242.648	7.10709	151.039	140.704
242.813	7.14561	213.586	139.946
242.977	7.1745	168.703	139.382
243.141	7.04931	196.906	141.858
243.305	6.83745	210.211	146.253
243.469	6.77967	204.898	147.5
243.633	6.84708	186.602	146.048
243.797	6.74115	176.391	148.343
243.961	6.80856	212.969	146.874
244.125	6.93375	232.586	144.222
244.289	7.23229	182.047	138.269
244.453	7.6849	190.805	130.125
244.617	7.2997	217.125	136.992
244.781	7.32859	210.977	136.452
244.945	7.44415	216.844	134.334
245.109	7.52119	188.391	132.958
245.273	7.19377	202.328	139.009
245.437	7.57897	245.125	131.944
245.601	7.60786	236.93	131.443
245.765	7.60786	194.07	131.443
245.929	7.52119	185.578	132.958
246.093	7.71379	162.773	129.638
246.257	7.396	173.773	135.208
246.421	7.13598	194.453	140.135

246.585	7.22266	228.641	138.453
246.75	7.16487	227.578	139.57
246.914	7.03005	176.063	142.246
247.078	7.1745	244.438	139.382
247.242	7.32859	225.82	136.452
247.406	7.38637	195.469	135.385
247.57	7.2034	205.008	138.823
247.734	7.01079	229.32	142.637
247.898	6.97227	193.727	143.425
248.062	7.14561	215.781	139.946
248.226	7.09746	213.023	140.895
248.39	7.19377	228.133	139.009
248.554	7.32859	220.758	136.452
248.718	7.29007	190.883	137.173
248.882	7.22266	196.156	138.453
249.046	7.38637	205.133	135.385
249.21	7.25155	205.258	137.902
249.374	7.29007	190.977	137.173
249.538	7.22266	246.102	138.453
249.702	7.03005	214.633	142.246
249.866	7.31896	227.992	136.631
250.03	7.32859	165.188	136.452
250.194	7.25155	164.789	137.902
250.358	7.22266	174.445	138.453
250.522	7.23229	249.938	138.269
250.686	7.42489	218.398	134.682
250.851	7.26118	232.695	137.719
251.015	7.29007	188.516	137.173
251.179	7.35748	218.781	135.916
251.343	7.38637	209.094	135.385
251.507	7.36711	209.672	135.738
251.671	7.44415	227.609	134.334
251.835	7.52119	253	132.958
251.999	7.32859	183.695	136.452
252.163	7.55008	194.094	132.449
252.327	7.4923	182.063	133.47
252.491	7.48267	235.273	133.642
252.655	7.2034	222.367	138.823
252.819	7.41526	226.57	134.857
252.983	7.55008	228.797	132.449
253.147	7.25155	173.664	137.902
253.311	7.29007	262.469	137.173
253.475	7.42489	211.742	134.682
253.639	7.52119	194.586	132.958
253.803	7.38637	246.453	135.385
253.967	7.396	218.32	135.208
254.131	7.63675	216.781	130.946
254.295	7.51156	266.203	133.128
254.459	7.45378	237.492	134.16
254.623	7.4923	257.75	133.47
254.787	7.6849	214.625	130.125
254.952	7.70416	249.68	129.8
255.116	7.6849	226.594	130.125
255.28	7.5886	198.664	131.777
255.444	7.396	212.25	135.208
255.608	7.396	267.625	135.208
255.772	7.35748	216.883	135.916
255.936	7.36711	256.313	135.738
256.1	7.34785	230.805	136.094
256.264	7.45378	180.453	134.16
256.428	7.12635	208.117	140.324
256.592	7.41526	249.32	134.857
256.756	7.46341	206.07	133.987
256.92	7.396	214.922	135.208
257.084	7.44415	202.148	134.334
257.248	7.55971	220.781	132.28
257.412	7.396	223.828	135.208
257.576	7.32859	188.109	136.452

257.74	7.35748	226.125	135.916
257.904	7.22266	249.875	138.453
258.068	7.51156	211.664	133.128
258.232	7.34785	256.938	136.094
258.396	7.396	209.438	135.208
258.56	7.48267	243.813	133.642
258.724	7.36711	193.836	135.738
258.888	7.41526	233.953	134.857
259.053	7.38637	215.594	135.385
259.217	7.34785	189.039	136.094
259.381	7.23229	229.602	138.269
259.545	7.42489	280.766	134.682
259.709	7.48267	229.609	133.642
259.873	7.54045	243.758	132.618
260.037	7.29007	238.43	137.173
260.201	7.54045	231.273	132.618
260.365	7.55008	220.039	132.449
260.529	7.25155	242.648	137.902
260.693	7.32859	215.43	136.452
260.857	7.2034	195.602	138.823
261.021	7.19377	240.273	139.009
261.185	7.38637	239.648	135.385
261.349	7.38637	253.703	135.385
261.513	7.55971	208.539	132.28
261.677	7.54045	229.352	132.618
261.841	7.35748	246.305	135.916
262.005	7.31896	234.938	136.631
262.169	7.54045	249.211	132.618
262.333	7.45378	240.664	134.16
262.497	7.396	220.211	135.208
262.661	7.2034	223.242	138.823
262.825	7.51156	246.617	133.128
262.99	7.2997	214.477	136.992
263.154	7.31896	240.961	136.631
263.318	7.36711	272.453	135.738
263.482	7.48267	234.672	133.642
263.646	7.26118	264.375	137.719
263.81	7.34785	266.75	136.094
263.974	7.80046	240.563	128.197
264.138	7.65601	211.602	130.616
264.302	7.73305	229.375	129.315
264.466	7.67527	235.508	130.289
264.63	7.67527	230.18	130.289
264.794	7.60786	223.336	131.443
264.958	7.71379	232.961	129.638
265.122	7.55971	240.172	132.28
265.286	7.396	221.766	135.208
265.45	7.35748	241.109	135.916
265.614	7.55008	273.813	132.449
265.778	7.61749	270.688	131.277
265.942	7.6849	217.695	130.125
266.106	7.52119	213.563	132.958
266.27	7.44415	202.586	134.334
266.434	7.54045	228.188	132.618
266.598	7.48267	231.406	133.642
266.762	7.55008	241.367	132.449
266.926	7.48267	241.469	133.642
267.091	7.35748	194.047	135.916
267.255	7.396	209.391	135.208
267.419	7.45378	200.297	134.16
267.583	7.36711	223.438	135.738
267.747	7.25155	237.234	137.902
267.911	7.23229	228.695	138.269
268.075	7.36711	257.078	135.738
268.239	7.48267	170.578	133.642
268.403	7.35748	226.023	135.916
268.567	7.55971	226.852	132.28
268.731	7.52119	221.508	132.958

268.895	7.52119	238.547	132.958
269.059	7.52119	182.852	132.958
269.223	7.42489	228.461	134.682
269.387	7.38637	182.586	135.385
269.551	7.35748	264.875	135.916
269.715	7.22266	231.766	138.453
269.879	7.48267	180.18	133.642
270.043	7.31896	216.805	136.631
270.207	7.4923	199.734	133.47
270.371	7.41526	253.563	134.857
270.535	7.57897	255.148	131.944
270.699	7.46341	260.516	133.987
270.863	7.36711	221.148	135.738
271.027	7.42489	245.414	134.682
271.192	7.38637	244.398	135.385
271.356	7.57897	188	131.944
271.52	7.42489	226.875	134.682
271.684	7.29007	166.977	137.173
271.848	7.26118	188.367	137.719
272.012	7.63675	220.367	130.946
272.176	7.42489	199.625	134.682
272.34	7.36711	194.156	135.738
272.504	7.38637	248.539	135.385
272.668	7.4923	231.523	133.47
272.832	7.25155	209.109	137.902
272.996	7.34785	217.977	136.094
273.16	7.38637	227.992	135.385
273.324	7.32859	224.289	136.452
273.488	7.396	242.172	135.208
273.652	7.01079	221.492	142.637
273.816	7.26118	194.125	137.719
273.98	7.26118	217	137.719
274.144	7.25155	253.078	137.902
274.308	7.34785	225.305	136.094
274.472	7.38637	219.828	135.385
274.636	7.46341	268.219	133.987
274.8	7.41526	252.711	134.857
274.964	7.48267	241.453	133.642
275.128	7.32859	213.641	136.452
275.293	7.25155	252.461	137.902
275.457	7.1745	257.828	139.382
275.621	7.46341	203.492	133.987
275.785	7.41526	223.07	134.857
275.949	7.22266	208.523	138.453
276.113	7.35748	213.836	135.916
276.277	7.38637	237.578	135.385
276.441	7.42489	239.742	134.682
276.605	7.61749	260.344	131.277
276.769	7.54045	217.391	132.618
276.933	7.44415	217.047	134.334
277.097	7.35748	226.023	135.916
277.261	7.38637	226.359	135.385
277.425	7.54045	182.773	132.618
277.589	7.32859	246.617	136.452
277.753	7.61749	250.453	131.277
277.917	7.54045	201.391	132.618
278.081	7.70416	250.656	129.8
278.245	7.48267	212.531	133.642
278.409	7.38637	217.516	135.385
278.573	7.396	266.75	135.208
278.737	7.48267	220.648	133.642
278.901	7.60786	216.742	131.443
279.065	7.51156	227.719	133.128
279.23	7.60786	205.07	131.443
279.394	7.52119	247.164	132.958
279.558	7.57897	232.281	131.944
279.722	7.57897	159.75	131.944
279.886	7.4923	228.258	133.47

280.05	7.51156	195.25	133.128
280.214	7.35748	272.5	135.916
280.378	7.29007	218.211	137.173
280.542	7.27081	221.273	137.536
280.706	7.52119	244.477	132.958
280.87	7.57897	250.016	131.944
281.034	7.57897	199.578	131.944
281.198	7.54045	251.344	132.618
281.362	7.45378	260.531	134.16
281.526	7.14561	238.352	139.946
281.69	7.48267	203.367	133.642
281.854	7.48267	221	133.642
282.018	7.38637	241.086	135.385
282.182	7.31896	244.828	136.631
282.346	7.65601	238.57	130.616
282.51	7.396	253.961	135.208
282.674	7.31896	192.148	136.631
282.838	7.29007	234.18	137.173
283.002	7.45378	241.5	134.16
283.166	7.48267	268.094	133.642
283.331	7.42489	186.438	134.682
283.495	7.6849	288.75	130.125
283.659	7.74268	273.656	129.154
283.823	7.51156	178.844	133.128
283.987	7.396	246.406	135.208
284.151	7.71379	251.305	129.638
284.315	7.36711	247.758	135.738
284.479	7.55008	209.672	132.449
284.643	7.46341	240.406	133.987
284.807	7.51156	228.32	133.128
284.971	7.48267	234.406	133.642
285.135	7.5886	202.281	131.777
285.299	7.52119	228.594	132.958
285.463	7.70416	272.578	129.8
285.627	7.64638	208.445	130.781
285.791	7.70416	254.422	129.8
285.955	7.6849	188.602	130.125
286.119	7.65601	256.031	130.616
286.283	7.57897	254.531	131.944
286.447	7.60786	218	131.443
286.611	7.51156	200.352	133.128
286.775	7.4923	252.586	133.47
286.939	7.51156	259.063	133.128
287.103	7.4923	244.734	133.47
287.267	7.57897	227.328	131.944
287.432	7.65601	248.063	130.616
287.596	7.396	207.078	135.208
287.76	7.57897	260.703	131.944
287.924	7.55008	243.242	132.449
288.088	7.4923	231.938	133.47
288.252	7.71379	228.078	129.638
288.416	7.71379	219.508	129.638
288.58	7.57897	279.391	131.944
288.744	7.57897	251.516	131.944
288.908	7.60786	245.633	131.443
289.072	7.5886	214.547	131.777
289.236	7.61749	197.391	131.277
289.4	7.52119	204.594	132.958
289.564	7.38637	261.422	135.385
289.728	7.54045	220.547	132.618
289.892	7.60786	228.891	131.443
290.056	7.5886	231.195	131.777
290.22	7.75231	184.906	128.994
290.384	7.60786	242.195	131.443
290.548	7.46341	251.344	133.987
290.712	7.61749	268.594	131.277
290.876	7.71379	220.445	129.638
291.04	7.44415	243.375	134.334

291.204	7.55008	241.531	132.449
291.368	7.45378	226.734	134.16
291.533	7.65601	269.813	130.616
291.697	7.41526	212.656	134.857
291.861	7.12635	238.117	140.324
292.025	7.38637	228.414	135.385
292.189	7.38637	247.188	135.385
292.353	7.42489	156.805	134.682
292.517	7.34785	248.664	136.094
292.681	7.42489	225.867	134.682
292.845	7.27081	230.172	137.536
293.009	7.27081	229.68	137.536
293.173	7.4923	242.672	133.47
293.337	7.396	247.391	135.208
293.501	7.38637	207.086	135.385
293.665	7.35748	264.234	135.916
293.829	7.48267	193.891	133.642
293.993	7.27081	233.656	137.536
294.157	7.27081	271.531	137.536
294.321	7.25155	194.148	137.902
294.485	7.35748	215.125	135.916
294.649	7.46341	216.523	133.987
294.813	7.45378	258.172	134.16
294.977	7.54045	239.68	132.618
295.141	7.6849	252.688	130.125
295.305	7.63675	191.867	130.946
295.47	7.67527	216.313	130.289
295.634	7.67527	247.023	130.289
295.798	7.48267	192.273	133.642
295.962	7.34785	252.031	136.094
296.126	7.57897	244.477	131.944
296.29	7.60786	249.805	131.443
296.454	7.26118	242.672	137.719
296.618	7.35748	278.938	135.916
296.782	7.55971	261.016	132.28
296.946	7.5886	288.25	131.777
297.11	7.60786	196.961	131.443
297.274	7.5886	243.594	131.777
297.438	7.44415	236.047	134.334
297.602	7.51156	213.727	133.128
297.766	7.55971	255.484	132.28
297.93	7.4923	221.047	133.47
298.094	7.57897	215.516	131.944
298.258	7.55971	259.859	132.28
298.422	7.4923	239.805	133.47
298.586	7.38637	231.602	135.385
298.75	7.36711	273.094	135.738
298.914	7.41526	221.695	134.857
299.078	7.4923	228.516	133.47
299.242	7.44415	219.961	134.334
299.406	7.42489	251.578	134.682
299.571	7.54045	256.703	132.618
299.735	7.52119	272.031	132.958
299.899	7.34785	225.852	136.094
300.063	7.52119	271.109	132.958
300.227	7.29007	220.32	137.173
300.391	7.4923	274.406	133.47
300.555	7.5886	204.273	131.777
300.719	7.51156	194.648	133.128
300.883	7.55971	201.477	132.28
301.047	7.32859	231.211	136.452
301.211	7.60786	244.977	131.443
301.375	8.0027	239	124.958
301.539	8.12789	264.031	123.033
301.703	7.99307	242.867	125.108
301.867	8.11826	220.195	123.179
302.031	8.32049	267.219	120.185
302.195	7.9064	210.266	126.48

302.359	7.93529	225.656	126.019
302.523	7.6849	279.516	130.125
302.687	7.64638	219.492	130.781
302.851	7.75231	234.469	128.994
303.015	7.94492	282.203	125.867
303.179	7.97381	252.266	125.411
303.343	7.97381	230.148	125.411
303.507	7.9064	259.469	126.48
303.672	8.099	219.57	123.472
303.836	7.94492	245.961	125.867
304	8.07011	219.305	123.914
304.164	7.97381	243.219	125.411
304.328	7.9064	205.703	126.48
304.492	7.55971	252.734	132.28
304.656	7.54045	267.703	132.618
304.82	7.34785	265.625	136.094
304.984	7.52119	267.688	132.958
305.148	7.6849	228.914	130.125
305.312	7.65601	211.758	130.616
305.476	7.70416	238.484	129.8
305.64	7.83899	238.742	127.568
305.804	7.9064	180.969	126.48
305.968	8.0027	275.25	124.958
306.132	7.87751	216.648	126.944
306.296	7.73305	239.992	129.315
306.46	7.77157	228.836	128.674
306.624	7.73305	273.297	129.315
306.788	7.64638	258.891	130.781
306.952	7.60786	244.086	131.443
307.116	7.51156	205.828	133.128
307.28	7.63675	264.156	130.946
307.444	7.4923	208.203	133.47
307.608	7.55008	259.031	132.449
307.773	7.6849	231.523	130.125
307.937	7.45378	262.391	134.16
308.101	7.46341	246.359	133.987
308.265	7.41526	265.641	134.857
308.429	7.36711	273.813	135.738
308.593	7.16487	190.93	139.57
308.757	7.16487	273.156	139.57
308.921	7.10709	225.141	140.704
309.085	7.25155	221.172	137.902
309.249	7.13598	237.703	140.135
309.413	7.06857	218.727	141.471
309.577	7.16487	277.719	139.57
309.741	7.06857	256.109	141.471
309.905	7.14561	196.102	139.946
310.069	7.27081	211.313	137.536
310.233	7.25155	253.617	137.902
310.397	7.31896	203.086	136.631
310.561	7.25155	199.805	137.902
310.725	7.19377	215.93	139.009
310.889	7.2034	243.68	138.823
311.053	7.26118	229.742	137.719
311.217	7.26118	225.828	137.719
311.381	7.10709	220.195	140.704
311.545	6.93375	239.453	144.222
311.71	7.03968	242.117	142.052
311.874	7.1745	275.938	139.382
312.038	7.22266	276.344	138.453
312.202	7.2997	247.523	136.992
312.366	7.29007	224.602	137.173
312.53	7.55008	210.461	132.449
312.694	7.38637	202.438	135.385
312.858	7.27081	202.438	137.536
313.022	7.32859	247.758	136.452
313.186	7.38637	298.391	135.385
313.35	7.16487	258.609	139.57

313.514	7.38637	251.648	135.385
313.678	7.38637	240.93	135.385
313.842	7.36711	190.383	135.738
314.006	7.4923	223.984	133.47
314.17	7.61749	257.609	131.277
314.334	7.51156	258.688	133.128
314.498	7.31896	274.031	136.631
314.662	7.51156	242.383	133.128
314.826	7.70416	223.227	129.8
314.99	7.41526	226.336	134.857
315.154	7.22266	244.242	138.453
315.318	7.44415	217.898	134.334
315.482	7.41526	231.523	134.857
315.646	7.396	230.938	135.208
315.811	7.31896	250.063	136.631
315.975	7.52119	224.32	132.958
316.139	7.26118	245.047	137.719
316.303	7.54045	239.352	132.618
316.467	7.54045	225.023	132.618
316.631	7.55971	222.891	132.28
316.795	7.4923	246.984	133.47
316.959	7.51156	224.859	133.128
317.123	7.41526	247.852	134.857
317.287	7.54045	204.609	132.618
317.451	7.4923	232.125	133.47
317.615	7.44415	252.227	134.334
317.779	7.38637	239.648	135.385
317.943	7.35748	240.359	135.916
318.107	7.52119	198.664	132.958
318.271	7.38637	254.117	135.385
318.435	7.41526	246.141	134.857
318.599	7.27081	321.813	137.536
318.763	7.26118	256.188	137.719
318.927	7.16487	194.305	139.57
319.091	7.396	231.375	135.208
319.255	7.61749	246.617	131.277
319.419	7.44415	274.75	134.334
319.583	7.45378	228.008	134.16
319.747	7.48267	242.234	133.642
319.912	7.5886	256.781	131.777
320.076	7.5886	250.453	131.777
320.24	7.60786	188.344	131.443
320.404	7.4923	258.672	133.47
320.568	7.38637	247.984	135.385
320.732	7.35748	199.555	135.916
320.896	7.25155	154.281	137.902
321.06	7.396	245.359	135.208
321.224	7.22266	257.922	138.453
321.388	7.32859	236.125	136.452
321.552	7.4923	210.367	133.47
321.716	7.55971	214.328	132.28
321.88	7.51156	253.234	133.128
322.044	7.396	231.711	135.208
322.208	7.42489	265.234	134.682
322.372	7.2997	240.961	136.992
322.536	7.42489	209.984	134.682
322.7	7.27081	266.078	137.536
322.864	7.44415	292.891	134.334
323.028	7.4923	209.656	133.47
323.192	7.5886	290.734	131.777
323.356	7.42489	231.07	134.682
323.52	7.60786	252.422	131.443
323.684	7.64638	243.313	130.781
323.848	7.46341	283.25	133.987
324.013	7.34785	178.172	136.094
324.177	7.44415	240.117	134.334
324.341	7.19377	180.906	139.009
324.505	7.31896	242.984	136.631

324.669	7.35748	245.469	135.916
324.833	7.42489	165.219	134.682
324.997	7.2997	259.688	136.992
325.161	7.48267	250.797	133.642
325.325	7.60786	284.563	131.443
325.489	7.46341	208.93	133.987
325.653	7.42489	210.68	134.682
325.817	7.2997	250.836	136.992
325.981	7.45378	293.078	134.16
326.145	7.48267	220.578	133.642
326.309	7.29007	259.5	137.173
326.473	7.2997	297.391	136.992
326.637	7.27081	249.438	137.536
326.801	7.45378	271.656	134.16
326.965	7.48267	265.719	133.642
327.129	7.38637	254.703	135.385
327.293	7.31896	234.328	136.631
327.457	7.35748	230.906	135.916
327.621	7.34785	226.875	136.094
327.785	7.42489	234.305	134.682
327.949	7.38637	214.703	135.385
328.114	7.31896	255.125	136.631
328.278	7.14561	231.352	139.946
328.442	7.27081	218.68	137.536
328.606	7.41526	239.586	134.857
328.77	7.31896	285.438	136.631
328.934	7.26118	254.523	137.719
329.098	7.36711	236.383	135.738
329.262	7.44415	262.672	134.334
329.426	7.42489	191.484	134.682
329.59	7.44415	248.484	134.334
329.754	7.32859	202.945	136.452
329.918	7.35748	227.977	135.916
330.082	7.32859	247.266	136.452
330.246	7.31896	202.844	136.631
330.41	7.38637	236.82	135.385
330.574	7.45378	233.867	134.16
330.738	7.27081	240.93	137.536
330.902	7.14561	249.602	139.946
331.066	7.01079	313.578	142.637
331.23	7.16487	215.953	139.57
331.394	7.12635	218.18	140.324
331.558	7.03968	255.148	142.052
331.722	6.94338	253.625	144.022
331.886	7.06857	290.5	141.471
332.05	7.10709	219.797	140.704
332.215	7.34785	270.906	136.094
332.379	7.46341	232.344	133.987
332.543	7.31896	250.609	136.631
332.707	7.48267	246.43	133.642
332.871	7.32859	255.617	136.452
333.035	7.41526	287.359	134.857
333.199	7.32859	248.875	136.452
333.363	7.03968	293.906	142.052
333.527	7.2034	259.766	138.823
333.691	7.2034	251.133	138.823
333.855	7.26118	237.711	137.719
334.019	7.23229	290.406	138.269
334.183	7.29007	237.727	137.173
334.347	7.42489	280.781	134.682
334.511	7.35748	255.328	135.916
334.675	7.61749	264.922	131.277
334.839	7.57897	220.625	131.944
335.003	7.82935	204.281	127.724
335.167	7.73305	235.664	129.315
335.331	7.65601	198.508	130.616
335.495	7.396	291.203	135.208
335.659	7.51156	235.117	133.128

335.823	7.48267	250.953	133.642
335.987	7.44415	285.703	134.334
336.151	7.42489	274.719	134.682
336.316	7.48267	279.797	133.642
336.48	7.396	222.234	135.208
336.644	7.36711	271.063	135.738
336.808	7.44415	223.867	134.334
336.972	7.55008	233.086	132.449
337.136	7.51156	280.938	133.128
337.3	7.65601	294.75	130.616
337.464	7.45378	253.148	134.16
337.628	7.48267	263.875	133.642
337.792	7.31896	248.922	136.631
337.956	7.23229	230.727	138.269
338.12	7.03005	220.117	142.246
338.284	7.32859	211.258	136.452
338.448	7.23229	227.82	138.269
338.612	7.13598	283.813	140.135
338.776	7.22266	239.648	138.453
338.94	7.32859	228.461	136.452
339.104	7.35748	274.297	135.916
339.268	7.396	247.633	135.208
339.432	7.45378	259.531	134.16
339.596	7.45378	247.023	134.16
339.76	7.396	271.094	135.208
339.924	7.42489	247.156	134.682
340.088	7.44415	263.188	134.334
340.253	7.35748	245.969	135.916
340.417	7.16487	298.234	139.57
340.581	7.00116	207.313	142.833
340.745	7.35748	285.75	135.916
340.909	7.2997	255.539	136.992
341.073	7.32859	267.172	136.452
341.237	7.31896	251.883	136.631
341.401	7.34785	229.328	136.094
341.565	7.25155	233.367	137.902
341.729	7.16487	251.328	139.57
341.893	7.14561	188.883	139.946
342.057	7.26118	261.469	137.719
342.221	7.34785	291.313	136.094
342.385	7.29007	252.188	137.173
342.549	7.41526	245.031	134.857
342.713	7.42489	245.594	134.682
342.877	7.31896	241.352	136.631
343.041	7.54045	257.063	132.618
343.205	7.4923	223.023	133.47
343.369	7.31896	235.641	136.631
343.533	7.26118	227.008	137.719
343.697	7.35748	241.344	135.916
343.861	7.26118	252.773	137.719
344.025	7.03968	244.25	142.052
344.189	7.27081	250.281	137.536
344.354	7.22266	237.938	138.453
344.518	7.31896	264.672	136.631
344.682	7.31896	274.828	136.631
344.846	7.09746	240.977	140.895
345.01	7.0782	205.781	141.279
345.174	6.9819	219.57	143.227
345.338	7.22266	230.758	138.453
345.502	7.31896	271.125	136.631
345.666	7.35748	265.453	135.916
345.83	7.396	267.688	135.208
345.994	7.2997	290.844	136.992
346.158	7.29007	225.672	137.173
346.322	7.35748	251.961	135.916
346.486	7.4923	254.531	133.47
346.65	7.55008	262.75	132.449
346.814	7.48267	221.383	133.642

346.978	7.48267	271.188	133.642
347.142	7.55971	246.406	132.28
347.306	7.2034	215.313	138.823
347.47	7.1745	209.188	139.382
347.634	7.31896	220.781	136.631
347.798	7.03968	208.039	142.052
347.962	7.29007	314.016	137.173
348.126	7.10709	253.719	140.704
348.29	7.2034	280.156	138.823
348.455	7.0782	239.211	141.279
348.619	7.01079	249.852	142.637
348.783	7.03968	265.344	142.052
348.947	7.06857	238.453	141.471
349.111	7.10709	268.391	140.704
349.275	7.01079	248.617	142.637
349.439	7.01079	185.531	142.637
349.603	7.1745	276.156	139.382
349.767	7.09746	267.281	140.895
349.931	7.12635	225.719	140.324
350.095	7.27081	256.859	137.536
350.259	7.2997	282.641	136.992
350.423	7.23229	305.578	138.269
350.587	7.38637	256.844	135.385
350.751	7.54045	270.813	132.618
350.915	7.32859	248.266	136.452
351.079	7.396	217.781	135.208
351.243	7.2997	275.297	136.992
351.407	7.16487	202.438	139.57
351.571	7.09746	212.344	140.895
351.735	7.04931	263.672	141.858
351.899	7.03005	229.109	142.246
352.063	6.95301	255.523	143.823
352.227	7.04931	258.531	141.858
352.391	7.01079	222.367	142.637
352.556	6.9819	266.672	143.227
352.72	6.8856	232.75	145.231
352.884	7.14561	230.055	139.946
353.048	6.85671	237.969	145.843
353.212	6.93375	229.789	144.222
353.376	6.93375	274.203	144.222
353.54	6.77967	303.172	147.5
353.704	6.95301	217.125	143.823
353.868	7.03005	218.188	142.246
354.032	6.94338	256.5	144.022
354.196	7.16487	232	139.57
354.36	7.12635	201.516	140.324
354.524	6.9819	241.258	143.227
354.688	7.12635	275.781	140.324
354.852	7.22266	273.344	138.453
355.016	7.2997	228.492	136.992
355.18	7.36711	220.188	135.738
355.344	7.2034	218.602	138.823
355.508	7.31896	252.32	136.631
355.672	7.12635	267.734	140.324
355.836	7.12635	244.828	140.324
356	7.09746	249.422	140.895
356.164	7.16487	225.75	139.57
356.328	7.03968	279.469	142.052
356.493	6.90486	248.836	144.826
356.657	6.91449	261.813	144.624
356.821	6.95301	223.844	143.823
356.985	6.84708	238.227	146.048
357.149	7.00116	273.656	142.833
357.313	6.93375	221.789	144.222
357.477	7.03968	201.156	142.052
357.641	6.87597	293.797	145.434
357.805	6.8856	273.984	145.231
357.969	6.77967	243.109	147.5

358.133	6.72189	232.156	148.768
358.297	6.7893	247.906	147.291
358.461	6.81819	248.992	146.667
358.625	6.7893	284.125	147.291
358.789	6.7893	274.375	147.291
358.953	6.76041	251.383	147.92
359.117	6.83745	237.297	146.253
359.281	6.81819	262.703	146.667
359.445	6.90486	264.813	144.826
359.609	6.8856	263.688	145.231
359.773	6.72189	224.219	148.768
359.937	6.72189	266.172	148.768
360.101	6.80856	272.672	146.874
360.265	6.91449	240.672	144.624
360.429	6.81819	218.055	146.667
360.594	6.90486	236.102	144.826
360.758	6.80856	254.836	146.874
360.922	6.87597	242.281	145.434
361.086	6.85671	245.258	145.843
361.25	6.76041	273.234	147.92
361.414	6.87597	224.891	145.434
361.578	6.84708	281.781	146.048
361.742	6.93375	234.469	144.222
361.906	6.75078	258.5	148.131
362.07	7.00116	247.063	142.833
362.234	7.00116	229.398	142.833
362.398	6.80856	253.289	146.874
362.562	6.9819	256.453	143.227
362.726	7.12635	255.273	140.324
362.89	6.93375	258.656	144.222
363.054	6.95301	263.922	143.823
363.218	7.12635	305.609	140.324
363.382	6.91449	245.156	144.624
363.546	6.90486	252.68	144.826
363.71	6.91449	235.523	144.624
363.874	7.06857	229.477	141.471
364.038	7.01079	212.375	142.637
364.202	6.9819	294.922	143.227
364.366	7.00116	294.688	142.833
364.53	6.94338	271.578	144.022
364.695	7.19377	247.156	139.009
364.859	6.97227	238.375	143.425
365.023	6.94338	263.484	144.022
365.187	6.9819	236.695	143.227
365.351	6.93375	232.836	144.222
365.515	7.04931	258.281	141.858
365.679	6.8856	277.578	145.231
365.843	6.84708	234.461	146.048
366.007	6.81819	245.633	146.667
366.171	6.84708	288.234	146.048
366.335	6.93375	289.922	144.222
366.499	6.81819	213.414	146.667
366.663	6.81819	260.984	146.667
366.827	6.7893	257.391	147.291
366.991	6.74115	254.578	148.343
367.155	6.65448	220.703	150.275
367.319	6.66411	218.781	150.058
367.483	6.68337	255.664	149.625
367.647	6.71226	234.305	148.981
367.811	6.80856	262.25	146.874
367.975	6.74115	244.063	148.343
368.139	6.76041	259.469	147.92
368.303	6.72189	241.18	148.768
368.467	6.68337	261.906	149.625
368.631	6.693	224.656	149.41
368.796	6.66411	241.18	150.058
368.96	6.84708	255.391	146.048
369.124	6.72189	211.906	148.768

369.288	6.66411	247.102	150.058
369.452	6.55818	249.391	152.481
369.616	6.71226	287.094	148.981
369.78	6.58707	262.109	151.813
369.944	6.693	315.328	149.41
370.108	6.45224	282.547	154.985
370.272	6.64485	212.656	150.493
370.436	6.74115	280.047	148.343
370.6	6.66411	264.563	150.058
370.764	6.62559	213.953	150.93
370.928	6.71226	260.563	148.981
371.092	6.71226	252.617	148.981
371.256	6.55818	240.258	152.481
371.42	6.56781	222.125	152.258
371.584	6.65448	280.703	150.275
371.748	6.83745	258.734	146.253
371.912	6.71226	245.398	148.981
372.076	6.51965	264.656	153.382
372.24	6.83745	273.719	146.253
372.404	6.68337	200.516	149.625
372.568	6.74115	270.734	148.343
372.732	6.65448	219.438	150.275
372.897	6.71226	285.25	148.981
373.061	6.68337	237.344	149.625
373.225	6.5967	255.898	151.591
373.389	6.58707	203.398	151.813
373.553	6.64485	234.68	150.493
373.717	6.61596	214.273	151.15
373.881	6.74115	224.781	148.343
374.045	6.39446	243.602	156.385
374.209	6.50039	269.016	153.837
374.373	6.49076	311.594	154.065
374.537	6.42335	269.5	155.682
374.701	6.40409	202.164	156.15
374.865	6.45224	298.047	154.985
375.029	6.26927	273.938	159.508
375.193	6.39446	225.266	156.385
375.357	6.35594	232.172	157.333
375.521	6.1826	236.617	161.744
375.685	6.15371	270.406	162.504
375.849	6.11519	247.188	163.527
376.013	5.89369	225.508	169.673
376.177	5.96111	222.938	167.754
376.341	5.84554	254.664	171.07
376.505	5.7685	201.414	173.355
376.669	5.70109	257.125	175.405
376.834	5.79739	280.938	172.491
376.998	5.91296	248.25	169.12
377.162	5.82628	261.313	171.636
377.326	5.7685	223.117	173.355
377.49	5.82628	228.156	171.636
377.654	5.7685	191.719	173.355
377.818	5.74924	220.711	173.936
377.982	5.75887	207.813	173.645
378.146	5.79739	246.75	172.491
378.31	5.94185	207.398	168.298
378.474	5.81665	194.883	171.92
378.638	5.94185	242.078	168.298
378.802	6.03815	289.156	165.614
378.966	5.94185	238.078	168.298
379.13	5.92259	237.586	168.845
379.294	5.85517	234.078	170.789
379.458	5.88406	208.203	169.951
379.622	5.99	224.68	166.945
379.786	6.04778	256.188	165.35
379.95	6.17297	242.016	161.997
380.114	6.0863	267.609	164.303
380.278	6.01889	267.813	166.144

380.442	6.24038	256.563	160.247
380.606	6.20186	294.594	161.242
380.77	6.10556	253.648	163.785
380.935	6.30779	298.344	158.534
381.099	6.13445	248.531	163.014
381.263	6.32705	287.25	158.052
381.427	6.45224	320.531	154.985
381.591	6.49076	278.156	154.065
381.755	6.56781	347.609	152.258
381.919	6.64485	289.203	150.493
382.083	6.52928	306.266	153.156
382.247	6.55818	280.563	152.481
382.411	6.68337	275.422	149.625
382.575	6.56781	257.047	152.258
382.739	6.72189	242.75	148.768
382.903	6.71226	251.258	148.981
383.067	6.66411	253.227	150.058
383.231	6.8856	271.703	145.231
383.395	6.84708	292.344	146.048
383.559	6.97227	284.484	143.425
383.723	6.9819	264.25	143.227
383.887	7.01079	274.563	142.637
384.051	6.97227	250.992	143.425
384.215	7.12635	249.313	140.324
384.379	7.25155	276.328	137.902
384.543	7.1745	259.844	139.382
384.707	7.19377	286.641	139.009
384.871	7.34785	285.281	136.094
385.036	7.51156	286.844	133.128
385.2	7.4923	290.891	133.47
385.364	7.80046	275.266	128.197
385.528	7.74268	253.758	129.154
385.692	7.86788	285.125	127.099
385.856	8.03159	302.531	124.508
386.02	8.31086	308	120.324
386.184	8.63829	261.875	115.764
386.348	8.76348	270.078	114.11
386.512	9.02349	275.266	110.822
386.676	9.52426	276.563	104.995
386.84	10.1021	284.641	98.9896
387.004	10.468	301.766	95.5291
387.168	11.2288	269.75	89.0567
387.332	12.0666	298.125	82.8732
387.496	12.9911	275.375	76.9757
387.66	14.166	282.063	70.5916
387.824	15.3024	288.328	65.3494
387.988	16.8913	276.969	59.202
388.152	18.5573	243.789	53.887
388.316	20.1656	291.328	49.5895
388.48	21.8123	304.422	45.8456
388.644	23.671	279.578	42.2459
388.808	25.3081	276.344	39.5131
388.972	26.4541	327.156	37.8014
389.137	27.186	317.984	36.7837
389.301	27.6386	302.078	36.1813
389.465	28.2549	303.813	35.3921
389.629	28.0334	309.813	35.6717
389.793	27.8119	278.172	35.9558
389.957	27.3786	283.672	36.5249
390.121	27.1378	268.781	36.849
390.285	26.8874	292.063	37.1921
390.449	26.483	252.109	37.7601
390.613	25.9148	272.672	38.588
390.777	25.4333	257.125	39.3186
390.941	24.7977	292.609	40.3264
391.105	24.1332	218.703	41.4367
391.269	23.2183	305.781	43.0694
391.433	22.1975	282.484	45.05

391.597	20.9649	262.266	47.6988
391.761	19.9248	201.945	50.1887
391.925	18.8174	205.695	53.1424
392.089	17.8255	197.188	56.0996
392.253	16.8528	195.297	59.3373
392.417	15.8802	181.398	62.9717
392.581	15.2542	164.898	65.5557
392.745	14.6282	158.633	68.3609
392.909	14.3971	147.875	69.4583
393.074	13.7808	138.453	72.5648
393.238	13.3089	95.6328	75.1376
393.402	12.6059	119.148	79.3279
393.566	12.2785	145.086	81.4433
393.73	11.9414	121.66	83.7421
393.894	11.7392	107.211	85.1847
394.058	11.6429	129.063	85.8893
394.222	11.6429	119.844	85.8893
394.386	11.7392	98.2813	85.1847
394.55	11.9318	125.293	83.8097
394.714	12.7118	104.566	78.6668
394.878	13.28	99.668	75.3011
395.042	13.0296	97.6055	76.7481
395.206	12.2785	90.8555	81.4433
395.37	10.7569	81.8633	92.9634
395.534	8.59977	109.48	116.282
395.698	7.26118	108.02	137.719
395.862	5.52775	91.2852	180.905
396.026	2.98539	60.9531	334.965
396.19	0.664523	83.625	1504.84
396.354	3.10095	89.2852	322.482
396.518	8.04122	50.1133	124.359
396.682	9.8228	69.8438	101.804
396.846	10.3717	60.4473	96.4161
397.01	10.9399	67.8203	91.4086
397.175	11.8644	37.5039	84.2858
397.339	11.8162	64.7227	84.6293
397.503	11.3636	55.6699	88.0001
397.667	9.73612	61.9648	102.71
397.831	5.78776	56.959	172.778
397.995	2.88909	43.8086	346.13
398.159	2.39795	42.3984	417.023
398.323	1.72384	64.2852	580.1
398.487	2.10905	64.8398	474.148
398.651	5.08476	82.6328	196.666
398.815	8.5131	58.2344	117.466
398.979	8.47457	96.6836	118
399.143	8.37827	92.9961	119.356
399.307	7.93529	64.1367	126.019
399.471	6.84708	62.543	146.048
399.635	6.75078	80.4258	148.131
399.799	7.32859	53.8613	136.452
399.963	6.77967	54.3281	147.5
400.127	7.29007	74.1719	137.173
400.291	7.55971	64.2734	132.28
400.455	7.45378	55.4023	134.16
400.619	7.41526	44.6855	134.857
400.783	7.55008	53.3848	132.449
400.947	7.52119	62.5684	132.958
401.111	7.29007	44.5293	137.173
401.276	7.01079	81.9648	142.637
401.44	6.85671	42.7793	145.843
401.604	6.65448	61.0488	150.275
401.768	6.26927	59.082	159.508
401.932	6.20186	47.0059	161.242
402.096	6.32705	51.2188	158.052
402.26	6.62559	27.4023	150.93
402.424	6.30779	33.0117	158.534
402.588	6.33668	40.4043	157.811

402.752	6.25964	55.2813	159.754
402.916	5.96111	31.2021	167.754
403.08	5.78776	42.1953	172.778
403.244	5.7685	54.0234	173.355
403.408	5.5759	46.4434	179.343
403.572	5.55664	44.7012	179.965
403.736	5.7685	60.8867	173.355
403.9	6.17297	37.4102	161.997
404.064	6.49076	57.9668	154.065
404.228	7.32859	60.8027	136.452
404.392	8.66718	38.9941	115.378
404.556	9.01386	40.7285	110.94
404.72	8.6094	39.4375	116.152
404.884	7.94492	44.6816	125.867
405.048	7.10709	41.1738	140.704
405.212	7.25155	33.7773	137.902
405.377	7.97381	41.0762	125.411
405.541	9.42796	51.5508	106.067
405.705	10.0828	32.0918	99.1787
405.869	10.8821	53.6191	91.8939
406.033	11.8066	34.1523	84.6983
406.197	10.9784	39.7031	91.0878
406.361	9.25462	50.7891	108.054
406.525	8.26271	66.0195	121.026
406.689	9.53389	43.7813	104.889
406.853	8.84052	35.0215	113.116
407.017	8.34938	53.1836	119.769
407.181	8.86941	43.9551	112.747
407.345	11.6429	25.7314	85.8893
407.509	10.1984	42.0313	98.0549
407.673	9.01386	59.373	110.94
407.837	10.6799	28.6855	93.634
408.001	8.15678	55.5859	122.597
408.165	6.68337	65.0469	149.625
408.329	7.10709	68.8281	140.704
408.493	7.75231	52.373	128.994
408.657	8.2916	61.498	120.604
408.821	7.32859	48.9727	136.452
408.985	6.00926	65.5977	166.41
409.149	5.31589	39.3594	188.115
409.314	5.46997	56.4805	182.816
409.478	5.70109	67.5547	175.405
409.642	5.50849	71.1953	181.538
409.806	4.76697	51.4922	209.777
409.97	4.43954	49.8555	225.248
410.134	4.69956	64.3242	212.786
410.298	4.83438	37.8066	206.852
410.462	4.75734	74.0469	210.202
410.626	4.67067	86.5352	214.102
410.79	4.70919	71.1445	212.351
410.954	4.67067	65.7539	214.102
411.118	4.8729	68.3047	205.217
411.282	5.31589	71.7578	188.115
411.446	5.30626	67.6523	188.457
411.61	5.37367	62.2773	186.093
411.774	5.50849	62.4512	181.538
411.938	5.59516	83.625	178.726
412.102	5.30626	72.5742	188.457
412.266	5.36404	52.2637	186.427
412.43	5.31589	36.6055	188.115
412.594	5.15217	62.3066	194.093
412.758	5.0655	56.6699	197.414
412.922	5.26774	51.7969	189.835
413.086	5.24847	31.2441	190.532
413.25	5.31589	48.6074	188.115
413.415	5.70109	55.5781	175.405
413.579	5.46997	65.418	182.816
413.743	5.56627	51.8223	179.654

413.907	5.21958	37.2949	191.586
414.071	4.95957	39.1504	201.63
414.235	5.02698	51.6973	198.927
414.399	5.15217	40.8164	194.093
414.563	5.08476	42.9277	196.666
414.727	4.90179	46.998	204.007
414.891	5.287	44.8652	189.143
415.055	5.6722	47.1484	176.298
415.219	5.72035	34.6523	174.814
415.383	5.72035	49.416	174.814
415.547	5.78776	52.9766	172.778
415.711	6.07667	42.0254	164.564
415.875	6.15371	43.8145	162.504
416.039	6.26927	49.2715	159.508
416.203	6.24038	29.3701	160.247
416.367	6.01889	56.6934	166.144
416.531	5.55664	45.4727	179.965
416.695	5.46034	40.8398	183.139
416.859	5.19069	36.8809	192.652
417.023	5.0655	43.7617	197.414
417.187	5.37367	29.5859	186.093
417.351	5.20995	41.582	191.94
417.516	5.17143	39.627	193.37
417.68	5.04624	36.8984	198.167
417.844	5.15217	54.25	194.093
418.008	5.31589	37.2148	188.115
418.172	5.26774	37.2852	189.835
418.336	5.15217	28.4639	194.093
418.5	4.90179	49.8887	204.007
418.664	5.0655	42.7539	197.414
418.828	5.50849	46.6836	181.538
418.992	5.63368	41.498	177.504
419.156	5.5759	46.9863	179.343
419.32	5.81665	32.4395	171.92
419.484	5.69146	41.7969	175.702
419.648	5.44108	47.6875	183.787
419.812	5.55664	41.9883	179.965
419.976	5.4796	38.332	182.495
420.14	5.23884	45.6602	190.882
420.304	5.27737	40.2676	189.488
420.468	5.63368	53.4941	177.504
420.632	5.52775	27.9648	180.905
420.796	5.56627	22.4883	179.654
420.96	5.46997	52.7422	182.816
421.124	5.55664	34.0938	179.965
421.288	5.59516	49.5508	178.726
421.453	5.66257	37.627	176.598
421.617	5.84554	49.7129	171.07
421.781	6.04778	31.6875	165.35
421.945	6.17297	41.1152	161.997
422.109	6.25964	37.832	159.754
422.273	6.21149	39.25	160.992
422.437	6.66411	34.0742	150.058
422.601	7.09746	46.4355	140.895
422.765	6.9819	62.1836	143.227
422.929	7.12635	35.6738	140.324
423.093	7.97381	42.8984	125.411
423.257	9.35092	50.127	106.941
423.421	9.90947	32.332	100.914
423.585	9.37981	26.9395	106.612
423.749	9.46648	45.2695	105.636
423.913	9.95762	49.0176	100.426
424.077	10.1213	38.3477	98.8012
424.241	11.4118	32.9043	87.6288
424.405	13.0778	33.1602	76.4655
424.569	14.5801	40.3418	68.5867
424.733	15.3987	39.2598	64.9407
424.897	14.686	42.2578	68.092

425.061	14.9846	15.9033	66.7354
425.225	13.7615	38.5703	72.6664
425.389	13.5015	29.8594	74.0658
425.554	12.5481	49.4082	79.6932
425.718	10.025	75.7344	99.7503
425.882	8.18567	43.8809	122.165
426.046	7.31896	35.7969	136.631
426.21	6.32705	57.2266	158.052
426.374	5.81665	31.0508	171.92
426.538	4.53584	56.8242	220.466
426.702	3.45727	45.207	289.246
426.866	2.87946	54.2441	347.288
427.03	2.21498	59.3809	451.472
427.194	2.45573	74.0938	407.211
427.358	2.79279	81.3008	358.065
427.522	2.71575	77.3867	368.223
427.686	2.75427	81.0273	363.073
427.85	3.01428	59.0781	331.754
428.014	3.64987	111.355	273.982
428.178	3.93877	92.1406	253.886
428.342	4.38176	81.9648	228.219
428.506	4.46843	82.1875	223.792
428.67	3.97729	70.1484	251.427
428.834	4.18916	89.8008	238.711
428.998	4.28546	87.9375	233.347
429.162	5.18106	119.598	193.011
429.326	5.94185	92.7148	168.298
429.49	6.35594	107.332	157.333
429.655	6.07667	125.996	164.564
429.819	5.46997	135.164	182.816
429.983	4.6803	134.523	213.662
430.147	3.45727	98.2266	289.246
430.311	2.60018	111.465	384.588
430.475	2.08016	119.707	480.733
430.639	2.59055	89.6523	386.018
430.803	3.07206	112.102	325.514
430.967	3.51505	98.0195	284.491
431.131	4.51658	132.391	221.406
431.295	4.79586	103.867	208.513
431.459	4.42028	96.543	226.23
431.623	4.43954	101.813	225.248
431.787	4.80549	86.7227	208.095
431.951	4.92105	103.227	203.209
432.115	4.75734	66.0703	210.202
432.279	4.50695	104.992	221.879
432.443	3.73654	71.5781	267.627
432.607	3.30318	98.9141	302.738
432.771	3.57283	95.9961	279.89
432.935	4.28546	96.4688	233.347
433.099	5.34478	78.9023	187.099
433.263	5.65294	64.4297	176.899
433.427	5.11365	70.0664	195.555
433.591	4.10249	67.5117	243.755
433.756	3.81358	71.9102	262.221
433.92	4.42028	74.9414	226.23
434.084	4.6803	86.3477	213.662
434.248	4.50695	82.1602	221.879
434.412	4.31435	69.0039	231.785
434.576	4.41065	72.5898	226.724
434.74	5.01735	57.9277	199.308
434.904	5.50849	64.8242	181.538
435.068	5.20995	70.3086	191.94
435.232	5.11365	75.5313	195.555
435.396	5.88406	72.0977	169.951
435.56	7.51156	70.5078	133.128
435.724	8.3879	53.3672	119.219
435.888	8.26271	55.5469	121.026
436.052	8.28197	53.3125	120.744

436.216	8.13752	61.9766	122.888
436.38	7.46341	47.9883	133.987
436.544	6.54854	40.7617	152.706
436.708	5.84554	54.8457	171.07
436.872	5.43145	56.8633	184.113
437.036	5.55664	35.9375	179.965
437.2	5.287	47.2832	189.143
437.364	4.98846	51.3027	200.463
437.528	4.8729	44.3008	205.217
437.693	5.17143	67.7266	193.37
437.857	5.02698	51.6406	198.927
438.021	4.8729	59.9277	205.217
438.185	4.27583	81.6758	233.873
438.349	3.88099	58.6172	257.666
438.513	3.06243	84.1641	326.538
438.677	3.59209	75.4844	278.39
438.841	4.50695	57.3457	221.879
439.005	5.15217	58.2207	194.093
439.169	5.0655	60.7461	197.414
439.333	4.34324	56.6738	230.243
439.497	3.15873	61.5879	316.583
439.661	2.97576	56.0254	336.049
439.825	3.44764	53.0215	290.054
439.989	3.88099	51.8359	257.666
440.153	4.54547	55.6953	219.999
440.317	5.11365	58.7285	195.555
440.481	5.66257	54.9375	176.598
440.645	5.74924	60.3574	173.936
440.809	5.08476	56.6543	196.666
440.973	4.10249	53.1758	243.755
441.137	3.73654	58.5918	267.627
441.301	3.70765	34.0742	269.713
441.465	3.66913	49.2266	272.544
441.629	3.92914	55.25	254.508
441.794	3.81358	47.8164	262.221
441.958	3.99656	49.7441	250.215
442.122	3.97729	48.2773	251.427
442.286	4.39139	45.1934	227.718
442.45	4.44917	48.9785	224.761
442.614	3.83284	50.8613	260.903
442.778	3.76543	55.873	265.574
442.942	3.92914	45.8965	254.508
443.106	4.13138	29.998	242.05
443.27	4.10249	44.7266	243.755
443.434	4.10249	42.8809	243.755
443.598	4.24694	73.2461	235.464
443.762	4.69956	19.8408	212.786
443.926	5.19069	62.1484	192.652
444.09	4.93068	42.0723	202.812
444.254	3.92914	46.959	254.508
444.418	3.88099	47.2969	257.666
444.582	4.12175	42.8281	242.616
444.746	4.18916	47.1426	238.711
444.91	4.22768	42.5996	236.536
445.074	4.19879	75.832	238.164
445.238	4.15064	33.8223	240.927
445.402	4.22768	50.5449	236.536
445.566	4.41065	44.9043	226.724
445.73	4.28546	64.5586	233.347
445.895	4.22768	32.7168	236.536
446.059	4.10249	57.8945	243.755
446.223	4.17953	33.2813	239.261
446.387	3.86173	41.5195	258.951
446.551	3.92914	50.1035	254.508
446.715	3.83284	63.1836	260.903
446.879	3.54394	33.6328	282.172
447.043	3.49579	45.9727	286.059
447.207	3.68839	41.6582	271.121

447.371	3.67876	61.6133	271.831
447.535	3.49579	48.9902	286.059
447.699	3.61135	32.4941	276.905
447.863	3.66913	44.2539	272.544
448.027	3.68839	88.5508	271.121
448.191	3.48616	32.1602	286.849
448.355	3.33207	77.0313	300.113
448.519	3.38023	32.4199	295.838
448.683	3.51505	44.4727	284.491
448.847	3.81358	44.1953	262.221
449.011	3.68839	63.3262	271.121
449.175	3.81358	74.2148	262.221
449.339	3.74617	50.3359	266.939
449.503	3.84247	31.2832	260.249
449.667	3.64987	74.3516	273.982
449.831	3.38986	46.7285	294.998
449.996	3.29355	62.6406	303.623
450.16	3.76543	31.7441	265.574
450.324	4.12175	36.0762	242.616
450.488	4.10249	65.0781	243.755
450.652	3.80395	44.9063	262.884
450.816	3.61135	32.623	276.905
450.98	3.74617	51.1855	266.939
451.144	3.90025	42.916	256.394
451.308	3.96766	57.9727	252.037
451.472	3.97729	49.0957	251.427
451.636	3.93877	36.4492	253.886
451.8	3.92914	54.0156	254.508
451.964	3.64024	57.2969	274.707
452.128	3.78469	57.252	264.222
452.292	3.64024	35.6758	274.707
452.456	3.61135	78.2969	276.905
452.62	3.90988	46.4043	255.762
452.784	3.97729	42.5898	251.427
452.948	3.88099	42.6602	257.666
453.112	3.64987	45.7773	273.982
453.276	3.73654	69.6719	267.627
453.44	3.71728	69.1055	269.014
453.604	3.84247	30.668	260.249
453.768	3.83284	59.8672	260.903
453.933	4.03508	30.4824	247.827
454.097	4.02545	33.373	248.42
454.261	3.90988	32.7402	255.762
454.425	3.84247	52.3027	260.249
454.589	3.96766	39.666	252.037
454.753	3.88099	33.7207	257.666
454.917	3.99656	47.6563	250.215
455.081	3.92914	30.5449	254.508
455.245	4.0736	44.2441	245.483
455.409	4.05434	44.707	246.65
455.573	3.77506	45.0059	264.896
455.737	3.74617	58.5508	266.939
455.901	3.74617	40.8965	266.939
456.065	3.95803	60.6621	252.651
456.229	3.96766	33.2324	252.037
456.393	3.90025	49.5156	256.394
456.557	3.64024	32.6348	274.707
456.721	3.87136	27.8564	258.307
456.885	3.80395	61.6582	262.884
457.049	3.80395	40.377	262.884
457.213	3.80395	61.2891	262.884
457.377	3.68839	36.7832	271.121
457.541	3.76543	45.832	265.574
457.705	3.62098	54.8457	276.168
457.869	3.44764	41.8711	290.054
458.034	3.55357	38.2344	281.407
458.198	3.64024	43.0449	274.707
458.362	3.67876	46.4277	271.831

458.526	3.48616	69.4883	286.849
458.69	3.58246	29.2334	279.138
458.854	3.74617	41.5234	266.939
459.018	3.67876	63.6895	271.831
459.182	3.49579	43.1992	286.059
459.346	3.38986	31.1709	294.998
459.51	3.41875	56.2715	292.505
459.674	3.52468	60.1523	283.714
459.838	3.54394	54.9902	282.172
460.002	3.25503	35.5313	307.216
460.166	3.36097	50.9316	297.534
460.33	3.38986	47.2793	294.998
460.494	3.38023	34.3105	295.838
460.658	3.41875	43.3047	292.505
460.822	3.49579	37.4395	286.059
460.986	3.51505	37.0391	284.491
461.15	3.74617	62.2129	266.939
461.314	3.70765	52.4629	269.713
461.478	3.51505	15.376	284.491
461.642	3.48616	33.8633	286.849
461.806	3.28392	70.8711	304.514
461.97	3.58246	51.5352	279.138
462.135	3.48616	44.6328	286.849
462.299	3.51505	46.5508	284.491
462.463	3.36097	48.9004	297.534
462.627	3.41875	52.7559	292.505
462.791	3.48616	43.8418	286.849
462.955	3.32244	49.7793	300.983
463.119	3.42838	56.3184	291.683
463.283	3.48616	48.2246	286.849
463.447	3.47653	39.7734	287.643
463.611	3.44764	43.1367	290.054
463.775	3.32244	37.0566	300.983
463.939	3.51505	28.0967	284.491
464.103	3.62098	53.7344	276.168
464.267	3.67876	38.1719	271.831
464.431	3.66913	57.832	272.544
464.595	3.28392	41.4219	304.514
464.759	3.25503	50.4141	307.216
464.923	2.97576	37.4531	336.049
465.087	2.74464	18.665	364.347
465.251	2.56166	61.7969	390.371
465.415	2.01274	40.2051	496.834
465.579	1.75273	46.0508	570.538
465.743	1.99348	58.623	501.634
465.907	2.23424	33.9746	447.58
466.071	2.13794	52.4707	467.741
466.236	2.13794	39.834	467.741
466.4	2.30165	48.2695	434.471
466.564	2.20535	68.2852	453.443
466.728	2.46536	38.1855	405.62
466.892	2.85057	55.584	350.807
467.056	3.04317	40.959	328.605
467.22	2.90835	58.8164	343.838
467.384	3.07206	47.1641	325.514
467.548	2.64833	56.9688	377.596
467.712	2.31128	42.1738	432.661
467.876	2.40758	27.5615	415.355
468.04	2.60018	56.2461	384.588
468.204	2.93724	41.0332	340.456
468.368	2.85057	22.3857	350.807
468.532	2.87946	55	347.288
468.696	2.85057	51.2754	350.807
468.86	3.00465	54.5977	332.817
469.024	2.97576	44.2656	336.049
469.188	3.25503	31.4063	307.216
469.352	3.77506	34.1348	264.896
469.516	4.35287	46.5801	229.733

469.68	4.29509	71.0508	232.824
469.844	4.32398	43.3926	231.268
470.008	4.22768	46.5078	236.536
470.173	3.93877	37.0234	253.886
470.337	3.88099	49.5117	257.666
470.501	3.96766	55.9434	252.037
470.665	4.32398	39.834	231.268
470.829	4.16027	91.2383	240.369
470.993	3.93877	54.584	253.886
471.157	4.05434	54.5547	246.65
471.321	3.95803	51.8945	252.651
471.485	4.18916	33.5293	238.711
471.649	4.29509	36.7324	232.824
471.813	4.17953	42.5781	239.261
471.977	4.00619	32.582	249.614
472.141	3.71728	38.2422	269.014
472.305	3.49579	49.9395	286.059
472.469	3.38023	69.9961	295.838
472.633	3.62098	57.793	276.168
472.797	3.99656	55.4824	250.215
472.961	4.09286	35.5488	244.328
473.125	4.10249	36.5371	243.755
473.289	3.96766	46.0996	252.037
473.453	3.90988	37.1113	255.762
473.617	3.59209	30.3037	278.39
473.781	3.81358	57.2344	262.221
473.945	4.15064	42.2305	240.927
474.109	4.13138	45.0918	242.05
474.274	3.84247	44.9824	260.249
474.438	3.61135	36.0977	276.905
474.602	3.35134	50.6543	298.389
474.766	3.28392	35.2852	304.514
474.93	3.04317	69.5898	328.605
475.094	3.07206	48.8828	325.514
475.258	3.04317	42.6895	328.605
475.422	3.29355	68.4727	303.623
475.586	3.41875	43.0137	292.505
475.75	3.42838	40.123	291.683
475.914	3.54394	53.9883	282.172
476.078	3.71728	62.3281	269.014
476.242	3.62098	40.2285	276.168
476.406	3.51505	49.377	284.491
476.57	3.35134	70.5742	298.389
476.734	3.35134	52.5039	298.389
476.898	3.64987	58.2773	273.982
477.062	4.29509	29.3896	232.824
477.226	4.13138	36.0742	242.05
477.39	3.86173	46.0195	258.951
477.554	3.57283	40.8594	279.89
477.718	3.33207	39.9473	300.113
477.882	2.64833	39.5645	377.596
478.046	3.22614	36.2617	309.968
478.21	3.62098	57.4668	276.168
478.375	2.96613	39.1074	337.14
478.539	3.00465	48.4121	332.817
478.703	4.0736	50.957	245.483
478.867	4.42028	44.6914	226.23
479.031	3.47653	38.5137	287.643
479.195	3.57283	41.4238	279.89
479.359	3.99656	68.1406	250.215
479.523	4.42028	42.0234	226.23
479.687	4.37213	66.7344	228.721
479.851	4.21805	30.3232	237.076
480.015	4.22768	30.2354	236.536
480.179	4.15064	45.0176	240.927
480.343	4.27583	59.8105	233.873
480.507	4.6803	39.1133	213.662
480.671	4.69956	54.4492	212.786

480.835	4.63215	60.8828	215.883
480.999	5.01735	54.5742	199.308
481.163	5.08476	48.6797	196.666
481.327	5.04624	49.5176	198.167
481.491	4.90179	69.2734	204.007
481.655	5.36404	49.9453	186.427
481.819	5.7685	37.207	173.355
481.983	6.21149	33.7168	160.992
482.147	5.79739	63.9883	172.491
482.311	4.44917	48.4551	224.761
482.476	3.28392	51.5859	304.514
482.64	2.67722	33.3184	373.521
482.804	2.08016	65.9492	480.733
482.968	2.31128	53.8789	432.661
483.132	3.81358	45.1074	262.221
483.296	5.09439	51.125	196.294
483.46	5.81665	44.8105	171.92
483.624	6.50039	66.6953	153.837
483.788	6.8856	63.6895	145.231
483.952	7.2034	63.832	138.823
484.116	8.53236	48.5117	117.201
484.28	7.96418	48.6211	125.562
484.444	6.61596	45.748	151.15
484.608	6.40409	42.8711	156.15
484.772	6.75078	52.4297	148.131
484.936	7.16487	49.8184	139.57
485.1	7.0782	62.7051	141.279
485.264	7.00116	68.6094	142.833
485.428	6.64485	65.6563	150.493
485.592	6.32705	62.7617	158.052
485.756	6.25964	59.6035	159.754
485.92	6.50039	50.082	153.837
486.084	6.52928	89.5273	153.156
486.248	6.64485	64.2266	150.493
486.412	6.83745	54.9102	146.253
486.577	6.65448	57.5645	150.275
486.741	6.45224	48.459	154.985
486.905	6.0863	81.2383	164.303
487.069	5.79739	80.7891	172.491
487.233	5.49886	84.1836	181.856
487.397	5.55664	71.6719	179.965
487.561	5.36404	62.9004	186.427
487.725	5.53738	36.2324	180.591
487.889	5.08476	75.4531	196.666
488.053	5.12328	54.5723	195.187
488.217	4.94994	63.7773	202.023
488.381	5.09439	57.668	196.294
488.545	5.27737	60.9121	189.488
488.709	5.5759	72.6719	179.343
488.873	6.14408	63.5352	162.758
489.037	6.07667	92.2383	164.564
489.201	6.00926	49.8418	166.41
489.365	6.14408	65.7656	162.758
489.529	6.01889	53.1328	166.144
489.693	5.72035	90.1641	174.814
489.857	5.41219	72.1523	184.768
490.021	4.98846	40.7617	200.463
490.185	4.80549	49.918	208.095
490.349	4.82475	58.7344	207.265
490.513	4.94994	45.8457	202.023
490.678	4.94994	57.6602	202.023
490.842	4.79586	60.7188	208.513
491.006	4.67067	54.5488	214.102
491.17	4.50695	54.166	221.879
491.334	4.61288	63.1191	216.784
491.498	4.60325	44.9512	217.238
491.662	4.82475	71.9883	207.265
491.826	5.21958	57.2793	191.586

491.99	5.62405	57.2773	177.808
492.154	5.56627	72.5938	179.654
492.318	5.36404	54.8398	186.427
492.482	5.18106	79.332	193.011
492.646	5.52775	60.8418	180.905
492.81	6.40409	57.6055	156.15
492.974	7.4923	39.3711	133.47
493.138	8.06048	64.1484	124.062
493.302	8.16641	64.9688	122.453
493.466	9.17758	87.5195	108.961
493.63	10.4969	43.6523	95.2662
493.794	11.9896	55.8887	83.4058
493.958	13.5015	68.3945	74.0658
494.122	15.2638	46.9297	65.5144
494.286	16.1209	56.5664	62.0312
494.45	16.275	59.4277	61.4439
494.614	15.4179	58.7207	64.8596
494.779	11.9607	67.2578	83.6072
494.943	3.90025	60.9961	256.394
495.107	-11.0168	85.1055	-90.7701
495.271	-28.1296	57.2539	-35.5497
495.435	-40.7548	63.1406	-24.537
495.599	-46.9758	69.0195	-21.2875
495.763	-43.5282	32.8672	-22.9736
495.927	-33.224	53.9219	-30.0987
496.091	-26.4058	62.9258	-37.8704
496.255	-19.3277	69.5117	-51.7393
496.419	-12.0376	69.8047	-83.0727
496.583	-6.36549	57.7129	-157.097
496.747	-2.86974	54.8535	-348.463
496.911	-0.481465	55.123	-2077
497.075	0.770455	66.5898	1297.93
497.239	1.33863	54.7363	747.03
497.403	2.07053	73.1172	482.969
497.567	3.84247	119.766	260.249
497.731	5.12328	71.7266	195.187
497.895	6.01889	103.113	166.144
498.059	6.52928	106.223	153.156
498.223	6.66411	97	150.058
498.387	6.51965	87.4766	153.382
498.551	6.87597	120.031	145.434
498.715	6.87597	116.52	145.434
498.88	6.9819	136.844	143.227
499.044	7.14561	111.102	139.946
499.208	7.19377	161.055	139.009
499.372	7.2034	126.898	138.823
499.536	7.6849	132.727	130.125
499.7	8.21456	108.488	121.735
499.864	8.9946	114.074	111.178
500.028	9.4087	122.641	106.285
500.192	9.90947	102.152	100.914
500.356	10.2658	117.656	97.411
500.52	10.6317	90.6172	94.0581
500.684	11.2384	81.7188	88.9804
500.848	11.431	75.6367	87.4812
501.012	11.8933	88.4453	84.0811
501.176	12.2881	57.7773	81.3795
501.34	12.8081	88.0625	78.0753
501.504	12.7407	42.4902	78.4884
501.668	11.5562	79.3984	86.5335
501.832	10.6221	55.3242	94.1434
501.996	10.7762	80.7695	92.7973
502.16	11.1903	56.3945	89.3633
502.324	11.6718	59.3672	85.6767
502.488	12.1822	46.7676	82.0871
502.652	13.3089	72.3945	75.1376
502.816	13.4341	62.875	74.4374
502.981	11.8162	84.6016	84.6293

503.145	10.3043	49.7168	97.0468
503.309	10.4295	82.7031	95.8819
503.473	11.2962	76.1172	88.5253
503.637	12.5192	78.8594	79.8771
503.801	11.6718	48.2012	85.6767
503.965	10.6125	69.1875	94.2288
504.129	9.47611	98.9531	105.529
504.293	9.05238	105.332	110.468
504.457	8.95608	107.641	111.656
504.621	9.2161	75.1328	108.506
504.785	10.6317	81.6914	94.0581
504.949	10.9206	60.6133	91.5698
505.113	10.1984	76.1563	98.0549
505.277	10.025	82.3086	99.7503
505.441	8.96571	94.3398	111.536
505.605	7.6849	76.5352	130.125
505.769	7.54045	78.8555	132.618
505.933	9.1198	88.3359	109.652
506.097	10.5258	83.2383	95.0047
506.261	10.7088	87.207	93.3814
506.425	11.1421	84.9688	89.7495
506.589	10.6895	56.2793	93.5497
506.753	9.75538	78.3281	102.507
506.917	8.67681	60.0098	115.25
507.082	7.04931	72.2109	141.858
507.246	5.69146	69.1641	175.702
507.41	6.68337	40.3203	149.625
507.574	8.31086	49.0234	120.324
507.738	9.63982	63.9043	103.736
507.902	10.7473	63.0742	93.0467
508.066	11.4214	72.0078	87.5549
508.23	11.2866	69.1953	88.6008
508.394	10.9977	51.0371	90.9283
508.558	10.6895	87	93.5497
508.722	10.208	57.1699	97.9624
508.886	9.88058	54.2285	101.209
509.05	9.46648	60.4707	105.636
509.214	8.98497	69.7344	111.297
509.378	8.35901	81.8086	119.631
509.542	7.81009	45.7637	128.039
509.706	7.14561	103.523	139.946
509.87	7.32859	42.3711	136.452
510.034	7.0782	66.8047	141.279
510.198	7.35748	61.6211	135.916
510.362	7.35748	55.6504	135.916
510.526	7.55971	56.0723	132.28
510.69	7.92566	72.125	126.173
510.854	8.03159	53.2441	124.508
511.019	7.94492	87.9922	125.867
511.183	8.12789	88.1055	123.033
511.347	8.07011	53.5293	123.914
511.511	7.73305	53.1777	129.315
511.675	8.07011	49.3438	123.914
511.839	8.76348	42.6836	114.11
512.003	9.81317	75.9609	101.904
512.167	9.85169	60.6797	101.505
512.331	9.98651	51.752	100.135
512.495	10.7569	63.7188	92.9634
512.659	11.2866	45.875	88.6008
512.823	11.6525	55.2266	85.8183
512.987	12.6059	46.2324	79.3279
513.151	12.7022	52.0938	78.7265
513.315	12.134	42.873	82.4128
513.479	11.5466	58.1563	86.6056
513.643	10.5836	64.3945	94.486
513.807	9.92873	73.7773	100.718
513.971	9.25462	52.3281	108.054
514.135	9.28351	48.8496	107.718

514.299	9.88058	52.0176	101.209
514.463	9.75538	64.7422	102.507
514.627	9.03312	52.6641	110.704
514.791	8.50347	71.5508	117.599
514.955	7.89677	43.6914	126.634
515.12	7.38637	53.2617	135.385
515.284	7.26118	59.5254	137.719
515.448	7.23229	40.7324	138.269
515.612	6.72189	85.0391	148.768
515.776	6.97227	52.957	143.425
515.94	7.00116	67.9336	142.833
516.104	6.94338	88.0508	144.022
516.268	6.97227	94.1328	143.425
516.432	7.12635	45.623	140.324
516.596	7.54045	73.1406	132.618
516.76	7.67527	63.832	130.289
516.924	7.54045	73.0352	132.618
517.088	7.01079	76.375	142.637
517.252	6.55818	79.5703	152.481
517.416	6.23075	46	160.494
517.58	6.35594	67.1367	157.333
517.744	6.7893	48.9668	147.291
517.908	6.693	64.3828	149.41
518.072	6.72189	64.4414	148.768
518.236	6.7893	61.043	147.291
518.4	6.62559	70.4453	150.93
518.564	6.15371	61.3164	162.504
518.728	6.11519	79.9727	163.527
518.892	6.05741	71.1133	165.087
519.056	6.10556	55.8301	163.785
519.221	6.30779	93.8477	158.534
519.385	6.51965	50.2363	153.382
519.549	6.2789	84.5664	159.264
519.713	6.32705	78.7852	158.052
519.877	6.01889	69.0313	166.144
520.041	6.26927	40.8984	159.508
520.205	6.43298	46.3008	155.449
520.369	6.32705	42.5234	158.052
520.533	6.36557	39.5313	157.095
520.697	6.21149	63.9258	160.992
520.861	6.21149	79.457	160.992
521.025	6.17297	45.8105	161.997
521.189	6.00926	54.8535	166.41
521.353	6.07667	70.3359	164.564
521.517	6.01889	73.4453	166.144
521.681	5.7685	61.2031	173.355
521.845	5.66257	55.0684	176.598
522.009	5.62405	79.3203	177.808
522.173	5.63368	67.0547	177.504
522.337	5.70109	64.2773	175.405
522.501	5.50849	69.9961	181.538
522.665	5.49886	52.1543	181.856
522.829	5.44108	55.2363	183.787
522.993	5.55664	67.6602	179.965
523.157	5.79739	65.0352	172.491
523.322	5.70109	55.8906	175.405
523.486	5.96111	68.4531	167.754
523.65	6.01889	53.3066	166.144
523.814	6.30779	62.6934	158.534
523.978	6.2789	56.377	159.264
524.142	6.52928	81.6797	153.156
524.306	6.68337	49.9063	149.625
524.47	6.95301	52.2813	143.823
524.634	7.26118	36.7051	137.719
524.798	7.64638	60.7402	130.781
524.962	7.89677	70.0938	126.634
525.126	7.87751	48.9004	126.944
525.29	7.45378	57.7715	134.16

525.454	6.66411	70.0625	150.058
525.618	6.32705	33.5918	158.052
525.782	6.14408	66.9492	162.758
525.946	6.00926	54.7617	166.41
526.11	5.84554	45.8457	171.07
526.274	5.98037	58.0645	167.214
526.438	6.29816	73.3711	158.777
526.602	6.72189	85.6875	148.768
526.766	6.61596	85.5469	151.15
526.93	6.61596	42.9492	151.15
527.094	6.45224	58.6406	154.985
527.259	6.01889	80.2383	166.144
527.423	5.66257	71.3125	176.598
527.587	5.18106	49.4727	193.011
527.751	4.82475	93.8594	207.265
527.915	4.67067	56.3633	214.102
528.079	4.63215	81.3164	215.883
528.243	4.79586	69.2578	208.513
528.407	4.8729	43.877	205.217
528.571	4.64178	87.5156	215.435
528.735	4.54547	49.3555	219.999
528.899	4.43954	51.8594	225.248
529.063	4.79586	54.9414	208.513
529.227	4.70919	79.1758	212.351
529.391	4.75734	54.6621	210.202
529.555	4.48769	57.707	222.832
529.719	4.35287	55.0137	229.733
529.883	4.13138	63.9043	242.05
530.047	3.88099	63.8379	257.666
530.211	3.84247	48.6172	260.249
530.375	4.0736	64.1055	245.483
530.539	4.09286	73.4727	244.328
530.703	4.57436	52.1328	218.61
530.867	4.75734	54.8516	210.202
531.031	4.53584	55.0547	220.466
531.195	4.28546	51.9824	233.347
531.36	3.86173	49.1875	258.951
531.524	3.87136	67.6523	258.307
531.688	3.90988	49.373	255.762
531.852	4.57436	30.9277	218.61
532.016	4.94994	62.6699	202.023
532.18	5.15217	56.3516	194.093
532.344	4.69956	71.8672	212.786
532.508	4.32398	68.9453	231.268
532.672	4.25657	53.25	234.931
532.836	4.48769	68.6641	222.832
533	4.46843	68.0117	223.792
533.164	4.58399	33.7266	218.15
533.328	4.73808	42.7422	211.056
533.492	4.70919	42.5684	212.351
533.656	4.80549	51.875	208.095
533.82	4.83438	61.1465	206.852
533.984	5.01735	60.9512	199.308
534.148	5.08476	67.4453	196.666
534.312	4.99809	57.9277	200.076
534.476	4.99809	73.0078	200.076
534.64	4.89216	61.0371	204.409
534.804	4.6803	55.1172	213.662
534.968	4.70919	39.8594	212.351
535.132	4.75734	64.418	210.202
535.296	4.86327	76.5898	205.623
535.461	4.89216	58.416	204.409
535.625	4.72845	64.7148	211.486
535.789	4.63215	58.1953	215.883
535.953	4.56473	55.8184	219.071
536.117	4.85364	68.1992	206.031
536.281	4.82475	52.748	207.265
536.445	5.05587	59.4141	197.79

536.609	5.11365	68.5195	195.555
536.773	5.33515	53.0723	187.436
536.937	5.24847	62.7031	190.532
537.101	5.05587	37.5625	197.79
537.265	4.95957	52.6758	201.63
537.429	4.83438	61.2656	206.852
537.593	4.86327	48.8359	205.623
537.757	4.67067	66.9688	214.102
537.921	5.05587	88.2852	197.79
538.085	4.95957	45.8242	201.63
538.249	4.85364	61.252	206.031
538.413	5.04624	48.7305	198.167
538.577	5.0655	39.4238	197.414
538.741	5.02698	73.0039	198.927
538.905	4.72845	60.9668	211.486
539.069	4.83438	67.293	206.852
539.233	4.69956	58.5723	212.786
539.397	4.69956	67.3164	212.786
539.562	4.73808	27.667	211.056
539.726	4.9692	58.4355	201.24
539.89	4.85364	55.1035	206.031
540.054	4.85364	52.1699	206.031
540.218	4.92105	77.0625	203.209
540.382	5.05587	43.373	197.79
540.546	4.7766	68.5938	209.354
540.71	4.67067	62.502	214.102
540.874	4.53584	46.7539	220.466
541.038	4.37213	53.3145	228.721
541.202	4.44917	50.1797	224.761
541.366	4.34324	75.7383	230.243
541.53	4.43954	34.2207	225.248
541.694	4.76697	70.5547	209.777
541.858	4.80549	51.7871	208.095
542.022	5.36404	79.293	186.427
542.186	5.05587	64.0742	197.79
542.35	5.27737	39.7305	189.488
542.514	5.09439	42.8691	196.294
542.678	5.24847	82.1211	190.532
542.842	5.55664	48.6543	179.965
543.006	5.85517	48.7188	170.789
543.17	5.99	54.9043	166.945
543.334	6.55818	70.2539	152.481
543.499	7.04931	70.1758	141.858
543.663	7.27081	45.9297	137.536
543.827	7.23229	61.5313	138.269
543.991	7.1745	76.8047	139.382
544.155	6.83745	49.0195	146.253
544.319	6.33668	67.4141	157.811
544.483	6.04778	67.6484	165.35
544.647	5.63368	49.5293	177.504
544.811	5.53738	52.9707	180.591
544.975	5.56627	49.8613	179.654
545.139	4.94994	56.5313	202.023
545.303	4.72845	37.5	211.486
545.467	4.05434	62.3906	246.65
545.631	2.97576	75.1914	336.049
545.795	2.14757	65.3789	465.643
545.959	1.22307	49.3301	817.613
546.123	0.693414	82.3516	1442.14
546.287	1.02084	45.6992	979.587
546.451	1.73347	48.6758	576.878
546.615	2.50388	67.1367	399.38
546.779	3.29355	69.9648	303.623
546.943	3.76543	91.1523	265.574
547.107	4.42028	60.6797	226.23
547.271	4.39139	94.4375	227.718
547.435	4.44917	88.7148	224.761
547.6	4.58399	97.6328	218.15

547.764	3.95803	76.4492	252.651
547.928	2.29202	61.541	436.297
548.092	-0.356273	70.7578	-2806.84
548.256	-3.07197	76.9727	-325.523
548.42	-4.67058	83.1992	-214.106
548.584	-6.20177	64.2422	-161.244
548.748	-6.15362	67.7891	-162.506
548.912	-3.96758	83.4063	-252.043
549.076	-1.15558	99.6211	-865.37
549.24	0.741565	87.9531	1348.5
549.404	2.20535	81.3359	453.443
549.568	2.85057	99.9453	350.807
549.732	2.04163	128.898	489.804
549.896	0.808976	90.9297	1236.13
550.06	0.231167	59.1074	4325.89
550.224	-0.125149	86.5742	-7990.48
550.388	-1.14594	103.668	-872.642
550.552	-2.71566	87.918	-368.235
550.716	-2.94678	112.512	-339.353
550.88	-2.186	99.9922	-457.456
551.044	-1.37707	115.781	-726.18
551.208	0.0963445	106.242	10379.4
551.372	2.72538	113.039	366.922
551.536	4.69956	103.785	212.786
551.701	5.44108	97.2852	183.787
551.865	5.33515	94.5078	187.436
552.029	5.15217	104.086	194.093
552.193	4.54547	104.387	219.999
552.357	4.35287	113.727	229.733
552.521	4.50695	110.754	221.879
552.685	4.82475	91.7109	207.265
552.849	5.11365	107.395	195.555
553.013	5.20995	119.863	191.94
553.177	5.08476	120.18	196.666
553.341	5.26774	87.4531	189.835
553.505	4.86327	84.3594	205.623
553.669	4.75734	118.555	210.202
553.833	4.58399	125.434	218.15
553.997	4.66104	112.953	214.545
554.161	4.6803	112.91	213.662
554.325	4.67067	143.289	214.102
554.489	4.70919	67.6875	212.351
554.653	4.50695	110.129	221.879
554.817	4.53584	81.8945	220.466
554.981	4.76697	124.848	209.777
555.145	4.60325	103.742	217.238
555.309	4.54547	106.434	219.999
555.473	4.66104	91.4453	214.545
555.637	4.69956	116.195	212.786
555.802	4.57436	113.582	218.61
555.966	4.72845	118.539	211.486
556.13	4.63215	131.313	215.883
556.294	4.73808	107.441	211.056
556.458	4.75734	64.7539	210.202
556.622	4.76697	110.707	209.777
556.786	4.79586	104.316	208.513
556.95	4.86327	113.16	205.623
557.114	4.6803	94.5273	213.662
557.278	4.64178	82.9883	215.435
557.442	4.7766	108.445	209.354
557.606	4.61288	83.6836	216.784
557.77	4.76697	127.957	209.777
557.934	4.73808	93.4531	211.056
558.098	4.70919	88.207	212.351
558.262	4.79586	90.9258	208.513
558.426	4.63215	141.211	215.883
558.59	4.61288	90.1992	216.784
558.754	4.70919	101.59	212.351

558.918	4.67067	70.2305	214.102
559.082	4.89216	121.992	204.409
559.246	4.92105	106.566	203.209
559.41	4.98846	112.828	200.463
559.574	4.80549	78.5703	208.095
559.738	4.76697	91.3086	209.777
559.903	4.76697	143.5	209.777
560.067	4.67067	112.793	214.102
560.231	4.64178	94.5352	215.435
560.395	4.79586	124.828	208.513
560.559	4.86327	116.879	205.623
560.723	4.90179	101.617	204.007
560.887	4.92105	122.633	203.209
561.051	4.82475	116.652	207.265
561.215	5.0655	91.8047	197.414
561.379	4.93068	127.762	202.812
561.543	4.93068	156.516	202.812
561.707	4.89216	86.5586	204.409
561.871	4.89216	105.266	204.409
562.035	5.01735	93.8164	199.308
562.199	5.02698	113.039	198.927
562.363	4.99809	113.262	200.076
562.527	5.12328	94.8594	195.187
562.691	5.01735	100.906	199.308
562.855	4.9692	90.043	201.24
563.019	4.86327	95.3711	205.623
563.183	4.70919	112.727	212.351
563.347	4.8729	112.719	205.217
563.511	4.79586	125.449	208.513
563.675	4.94994	106.629	202.023
563.84	4.7766	97.375	209.354
564.004	4.63215	131	215.883
564.168	4.83438	118.941	206.852
564.332	4.7766	85.6055	209.354
564.496	4.64178	73.0977	215.435
564.66	4.83438	119.234	206.852
564.824	5.14254	79.4922	194.456
564.988	5.09439	125.27	196.294
565.152	5.14254	134.719	194.456
565.316	4.98846	101.023	200.463
565.48	4.85364	88.4922	206.031
565.644	4.90179	122.656	204.007
565.808	4.9692	107.539	201.24
565.972	5.05587	98.5039	197.79
566.136	5.33515	96.3711	187.436
566.3	5.01735	112.129	199.308
566.464	5.12328	109.914	195.187
566.628	5.19069	119.645	192.652
566.792	4.95957	100.863	201.63
566.956	5.17143	115.723	193.37
567.12	4.9692	112.246	201.24
567.284	4.93068	119.453	202.812
567.448	5.01735	85.2461	199.308
567.612	5.0655	94.5664	197.414
567.776	5.02698	115.844	198.927
567.941	5.09439	97.625	196.294
568.105	5.01735	91.2461	199.308
568.269	4.72845	103.695	211.486
568.433	4.92105	106.676	203.209
568.597	4.99809	118.816	200.076
568.761	4.83438	91.8047	206.852
568.925	4.9692	97.9844	201.24
569.089	4.95957	85.543	201.63
569.253	4.80549	98.1367	208.095
569.417	4.76697	113.223	209.777
569.581	4.94994	76.2578	202.023
569.745	4.95957	98.8047	201.63
569.909	4.92105	88.9961	203.209

570.073	4.93068	88.7852	202.812
570.237	4.79586	107.914	208.513
570.401	4.94994	87.2734	202.023
570.565	4.63215	81.2148	215.883
570.729	4.51658	116.672	221.406
570.893	4.76697	69.2148	209.777
571.057	4.57436	123.227	218.61
571.221	4.73808	118.934	211.056
571.385	4.82475	96.0469	207.265
571.549	4.80549	101.125	208.095
571.713	4.85364	100.254	206.031
571.877	4.79586	103.344	208.513
572.042	4.86327	94.1836	205.623
572.206	4.82475	109.492	207.265
572.37	4.83438	121.785	206.852
572.534	4.82475	116.223	207.265
572.698	4.79586	82.207	208.513
572.862	4.83438	106.508	206.852
573.026	4.82475	101.109	207.265
573.19	4.94994	100.563	202.023
573.354	5.09439	107.277	196.294
573.518	4.95957	134.594	201.63
573.682	5.20995	103.746	191.94
573.846	5.08476	140.633	196.666
574.01	5.21958	104.164	191.586
574.174	5.287	76.5781	189.143
574.338	5.15217	98.2031	194.093
574.502	5.15217	123.543	194.093
574.666	5.15217	83.7461	194.093
574.83	5.19069	75.5469	192.652
574.994	5.11365	109.742	195.555
575.158	5.27737	65.7773	189.488
575.322	5.20995	97.5391	191.94
575.486	5.11365	109.109	195.555
575.65	5.31589	86.9297	188.115
575.814	5.37367	120.332	186.093
575.978	5.46997	66.9766	182.816
576.143	5.36404	112.895	186.427
576.307	5.31589	115.586	188.115
576.471	5.3833	63.9883	185.76
576.635	5.15217	110.531	194.093
576.799	5.02698	119.332	198.927
576.963	5.08476	112.953	196.666
577.127	5.17143	91.3516	193.37
577.291	5.23884	103.66	190.882
577.455	5.09439	128.828	196.294
577.619	4.86327	112.938	205.623
577.783	4.98846	94.6914	200.463
577.947	4.90179	103.746	204.007
578.111	4.93068	82.8203	202.812
578.275	4.85364	119.414	206.031
578.439	4.93068	98.2578	202.812
578.603	4.94994	83.1133	202.023
578.767	4.66104	92.2578	214.545
578.931	4.83438	108.77	206.852
579.095	4.7766	99.918	209.354
579.259	4.89216	87.1445	204.409
579.423	4.73808	75.043	211.056
579.587	4.75734	109.332	210.202
579.751	4.76697	84.4102	209.777
579.915	4.70919	102.578	212.351
580.08	4.83438	95.2422	206.852
580.244	4.66104	127.898	214.545
580.408	4.76697	106.422	209.777
580.572	4.73808	112.652	211.056
580.736	4.8729	88.8047	205.217
580.9	4.7766	113.23	209.354
581.064	4.90179	94.2227	204.007

581.228	4.89216	76.2656	204.409
581.392	4.85364	130.727	206.031
581.556	4.85364	103.746	206.031
581.72	4.95957	103.617	201.63
581.884	4.73808	121.762	211.056
582.048	4.8729	94.7891	205.217
582.212	4.72845	91.875	211.486
582.376	4.89216	128.406	204.409
582.54	5.09439	155.969	196.294
582.704	4.79586	110.313	208.513
582.868	4.86327	119.805	205.623
583.032	4.90179	86.8906	204.007
583.196	4.83438	114.582	206.852
583.36	4.83438	97.4102	206.852
583.524	4.90179	137.156	204.007
583.688	4.80549	100.188	208.095
583.852	4.95957	119.23	201.63
584.016	4.75734	125.836	210.202
584.181	4.70919	84.0547	212.351
584.345	4.73808	126.762	211.056
584.509	4.83438	112.535	206.852
584.673	4.64178	118.664	215.435
584.837	4.80549	85.6797	208.095
585.001	4.73808	107.145	211.056
585.165	4.93068	101.031	202.812
585.329	4.9692	112.469	201.24
585.493	4.90179	76.1523	204.007
585.657	4.83438	91.4258	206.852
585.821	4.89216	127.652	204.409
585.985	4.67067	99.668	214.102
586.149	4.60325	88.4844	217.238
586.313	4.90179	103.824	204.007
586.477	4.90179	79.6484	204.007
586.641	4.99809	122.375	200.076
586.805	4.90179	113.289	204.007
586.969	4.89216	107.316	204.409
587.133	4.8729	123.008	205.217
587.297	5.01735	92.8594	199.308
587.461	4.75734	114.57	210.202
587.625	4.73808	105.992	211.056
587.789	4.83438	112.27	206.852
587.953	4.93068	105.836	202.812
588.117	4.75734	97.4258	210.202
588.282	4.86327	74.9492	205.623
588.446	4.72845	106.066	211.486
588.61	4.7766	80.2383	209.354
588.774	4.75734	82.1133	210.202
588.938	4.80549	128.961	208.095
589.102	4.6803	88.6289	213.662
589.266	4.6803	94.1797	213.662
589.43	4.73808	103.781	211.056
589.594	4.73808	130.703	211.056
589.758	4.60325	124.859	217.238
589.922	4.47806	54.7988	223.311
590.086	4.69956	114.887	212.786
590.25	4.58399	100.363	218.15
590.414	4.63215	82.5547	215.883
590.578	4.38176	103.98	228.219
590.742	4.75734	119.777	210.202
590.906	4.70919	86.0234	212.351
591.07	4.63215	95.207	215.883
591.234	4.57436	129.25	218.61
591.398	4.50695	104.445	221.879
591.562	4.66104	83.2227	214.545
591.726	4.64178	108.926	215.435
591.89	4.56473	109.16	219.071
592.054	4.58399	134.063	218.15
592.218	4.50695	100.285	221.879

592.383	4.57436	109.363	218.61
592.547	4.8729	103.27	205.217
592.711	4.69956	96.4766	212.786
592.875	4.73808	92.7266	211.056
593.039	4.72845	122.203	211.486
593.203	4.66104	91.0234	214.545
593.367	4.72845	94.2422	211.486
593.531	4.72845	94.3359	211.486
593.695	4.80549	100.309	208.095
593.859	4.80549	100.852	208.095
594.023	4.67067	100.23	214.102
594.187	4.54547	99.7344	219.999
594.351	4.44917	118.086	224.761
594.515	4.44917	125.055	224.761
594.679	4.43954	131.367	225.248
594.843	4.6803	119.48	213.662
595.007	4.58399	103.813	218.15
595.171	4.54547	107.406	219.999
595.335	4.6803	122.512	213.662
595.499	4.60325	104.125	217.238
595.663	4.60325	128.945	217.238
595.827	4.43954	138.813	225.248
595.991	4.50695	105.121	221.879
596.155	4.46843	96.9414	223.792
596.32	4.37213	77.9492	228.721
596.484	4.60325	87.4141	217.238
596.648	4.56473	106.289	219.071
596.812	4.44917	96.6953	224.761
596.976	4.50695	133.844	221.879
597.14	4.48769	77.7344	222.832
597.304	4.48769	100.789	222.832
597.468	4.54547	115.633	219.999
597.632	4.66104	103.434	214.545
597.796	4.34324	106.41	230.243
597.96	4.31435	119.441	231.785
598.124	4.37213	106.82	228.721
598.288	4.42028	127.43	226.23
598.452	4.53584	112.23	220.466
598.616	4.61288	116.035	216.784
598.78	4.35287	106.316	229.733
598.944	4.27583	131.313	233.873
599.108	4.29509	88.7891	232.824
599.272	4.31435	107.563	231.785
599.436	4.38176	83.1055	228.219
599.6	4.39139	113.691	227.718
599.764	4.39139	104.008	227.718
599.928	4.50695	107.383	221.879
600.092	4.41065	101.18	226.724
600.256	4.38176	101.543	228.219
600.421	4.37213	87.0391	228.721
600.585	4.03508	65.3516	247.827
600.749	3.99656	103.281	250.215
600.913	4.29509	119.047	232.824
601.077	4.27583	134.492	233.873
601.241	4.37213	103.055	228.721
601.405	4.28546	111.344	233.347
601.569	4.24694	97.707	235.464
601.733	4.31435	112.457	231.785
601.897	4.31435	118.707	231.785
602.061	4.47806	112.836	223.311
602.225	4.46843	72.6523	223.792
602.389	4.35287	126.742	229.733
602.553	4.54547	97.1172	219.999
602.717	4.64178	94.8164	215.435
602.881	4.51658	88.0195	221.406
603.045	4.58399	130.938	218.15
603.209	4.57436	97.7266	218.61
603.373	4.53584	118.969	220.466

603.537	4.61288	92.0156	216.784
603.701	4.41065	113.277	226.724
603.865	4.48769	101.141	222.832
604.029	4.54547	122.355	219.999
604.193	4.51658	113.328	221.406
604.357	4.43954	113.348	225.248
604.522	4.32398	114.25	231.268
604.686	4.48769	90.1992	222.832
604.85	4.47806	99.9219	223.311
605.014	4.60325	135.117	217.238
605.178	4.53584	82.0547	220.466
605.342	4.48769	116.152	222.832
605.506	4.61288	124.254	216.784
605.67	4.60325	126.469	217.238
605.834	4.58399	61.4453	218.15
605.998	4.69956	115.793	212.786
606.162	4.47806	91.7148	223.311
606.326	4.54547	78.9063	219.999
606.49	4.63215	138.906	215.883
606.654	4.53584	121.305	220.466
606.818	4.50695	103.621	221.879
606.982	4.57436	100.332	218.61
607.146	4.37213	109.414	228.721
607.31	4.31435	106.164	231.785
607.474	4.44917	100.902	224.761
607.638	4.60325	122.203	217.238
607.802	4.47806	97.7539	223.311
607.966	4.58399	104.07	218.15
608.13	4.79586	73.5625	208.513
608.294	4.83438	116.438	206.852
608.458	4.85364	118.828	206.031
608.623	4.98846	70.7266	200.463
608.787	5.02698	95.6758	198.927
608.951	4.8729	118.586	205.217
609.115	4.8729	84.6836	205.217
609.279	4.8729	116.223	205.217
609.443	4.90179	112.898	204.007
609.607	4.6803	122.316	213.662
609.771	4.6803	140.078	213.662
609.935	4.76697	86.3008	209.777
610.099	4.61288	113.066	216.784
610.263	4.39139	94.7383	227.718
610.427	4.43954	79.1211	225.248
610.591	4.47806	135.961	223.311
610.755	4.44917	124.473	224.761
610.919	4.6803	94.2305	213.662
611.083	4.83438	124.461	206.852
611.247	4.94994	140.188	202.023
611.411	4.99809	109.68	200.076
611.575	4.95957	112.953	201.63
611.739	4.69956	76.4805	212.786
611.903	4.7766	88.6172	209.354
612.067	4.80549	107.598	208.095
612.231	4.93068	120.078	202.812
612.395	4.82475	101.684	207.265
612.56	4.9692	128.477	201.24
612.724	5.08476	122.477	196.666
612.888	5.05587	110.793	197.79
613.052	5.27737	52.5879	189.488
613.216	5.27737	122.344	189.488
613.38	5.3833	103.07	185.76
613.544	5.08476	97.6328	196.666
613.708	5.21958	126.215	191.586
613.872	5.31589	113.262	188.115
614.036	5.19069	127.477	192.652
614.2	4.98846	99.2148	200.463
614.364	4.94994	97.4922	202.023
614.528	5.04624	124.387	198.167

614.692	5.26774	111.535	189.835
614.856	5.14254	118.855	194.456
615.02	5.27737	139.93	189.488
615.184	5.09439	100.285	196.294
615.348	5.01735	121.16	199.308
615.512	5.23884	131.094	190.882
615.676	5.20995	109.508	191.94
615.84	5.17143	119.426	193.37
616.004	5.23884	97.7266	190.882
616.168	5.14254	118.828	194.456
616.332	5.37367	104.031	186.093
616.496	5.30626	104.047	188.457
616.661	5.41219	85.5781	184.768
616.825	5.46997	116.426	182.816
616.989	5.46997	128.68	182.816
617.153	5.11365	58.6465	195.555
617.317	5.15217	118.156	194.093
617.481	5.11365	130.898	195.555
617.645	5.02698	130.852	198.927
617.809	5.05587	141.352	197.79
617.973	5.14254	116.766	194.456
618.137	4.99809	88.1133	200.076
618.301	4.92105	80.9922	203.209
618.465	5.14254	95.293	194.456
618.629	5.15217	76.1563	194.093
618.793	5.04624	142.273	198.167
618.957	4.95957	119.086	201.63
619.121	4.85364	106.93	206.031
619.285	4.73808	106.512	211.056
619.449	4.76697	100.563	209.777
619.613	4.8729	109.859	205.217
619.777	4.94994	100.395	202.023
619.941	5.08476	103.977	196.666
620.105	5.3833	128.313	185.76
620.269	5.18106	82.5234	193.011
620.433	5.21958	98.2539	191.586
620.597	5.287	91.7813	189.143
620.762	5.17143	91.5977	193.37
620.926	5.01735	70.1953	199.308
621.09	5.11365	79.8164	195.555
621.254	4.99809	135.406	200.076
621.418	5.04624	117.195	198.167
621.582	5.11365	86.4258	195.555
621.746	5.17143	102.238	193.37
621.91	5.15217	121.699	194.093
622.074	5.24847	125.371	190.532
622.238	5.41219	103.898	184.768
622.402	5.4796	100.414	182.495
622.566	5.44108	133.438	183.787
622.73	5.46997	157.219	182.816
622.894	5.27737	97.4609	189.488
623.058	5.41219	81.7578	184.768
623.222	5.36404	91.4883	186.427
623.386	5.66257	100.398	176.598
623.55	5.75887	82.0547	173.645
623.714	5.66257	91.4922	176.598
623.878	5.88406	115.688	169.951
624.042	5.74924	118.695	173.936
624.206	5.41219	97.5586	184.768
624.37	5.52775	76.2422	180.905
624.534	5.70109	98.207	175.405
624.698	5.75887	94.7422	173.645
624.863	5.59516	115.66	178.726
625.027	5.59516	103.762	178.726
625.191	5.98037	79.2461	167.214
625.355	5.85517	113.68	170.789
625.519	5.79739	86.1172	172.491
625.683	5.59516	116.922	178.726

625.847	5.69146	99.332	175.702
626.011	5.59516	87.5117	178.726
626.175	5.63368	93.8945	177.504
626.339	5.46997	106.77	182.816
626.503	5.62405	101.008	177.808
626.667	5.8648	94.1055	170.509
626.831	5.72035	124.457	174.814
626.995	5.46034	85.8906	183.139
627.159	5.46997	88.6367	182.816
627.323	5.66257	130.984	176.598
627.487	5.59516	124.488	178.726
627.651	5.56627	85.4219	179.654
627.815	5.56627	97.7461	179.654
627.979	5.60479	112.652	178.419
628.143	5.55664	85.4375	179.965
628.307	5.84554	121.813	171.07
628.471	5.91296	99.9609	169.12
628.635	5.79739	100.723	172.491
628.8	5.91296	121.582	169.12
628.964	6.04778	97.3477	165.35
629.128	5.8648	134.016	170.509
629.292	6.00926	146.883	166.41
629.456	6.23075	113.441	160.494
629.62	6.1826	131.656	161.744
629.784	6.21149	98.2266	160.992
629.948	6.15371	117.191	162.504
630.112	6.11519	115.285	163.527
630.276	6.14408	130.875	162.758
630.44	6.1826	106.313	161.744
630.604	6.17297	112.559	161.997
630.768	6.25964	103.164	159.754
630.932	6.35594	131.383	157.333
631.096	6.33668	124.398	157.811
631.26	6.30779	111.367	158.534
631.424	6.20186	61.2383	161.242
631.588	6.26927	106.41	159.508
631.752	6.05741	109.066	165.087
631.916	6.15371	106.754	162.504
632.08	6.21149	76.0859	160.992
632.244	6.20186	94.4531	161.242
632.408	6.20186	112.871	161.242
632.572	6.11519	124.461	163.527
632.736	6.00926	100.543	166.41
632.901	6.39446	124.594	156.385
633.065	6.23075	106.395	160.494
633.229	6.1826	88.5898	161.744
633.393	6.0863	116.555	164.303
633.557	6.01889	123.477	166.144
633.721	5.98037	113.219	167.214
633.885	5.8648	100.973	170.509
634.049	5.84554	113.648	171.07
634.213	5.55664	80.3398	179.965
634.377	5.5759	102.977	179.343
634.541	5.75887	112.699	173.645
634.705	5.78776	146.055	172.778
634.869	5.62405	99.9961	177.808
635.033	5.53738	112.828	180.591
635.197	5.33515	109.43	187.436
635.361	5.34478	80.9727	187.099
635.525	5.20995	116.906	191.94
635.689	5.287	133.563	189.143
635.853	5.20995	109.027	191.94
636.017	5.24847	112.648	190.532
636.181	5.21958	94.1641	191.586
636.345	5.26774	103.473	189.835
636.509	5.26774	115.477	189.835
636.673	5.3833	100.188	185.76
636.837	5.27737	125.113	189.488

637.002	5.09439	69.7578	196.294
637.166	5.20995	84.9219	191.94
637.33	5.05587	109.328	197.79
637.494	5.19069	131.203	192.652
637.658	5.287	100.855	189.143
637.822	5.20995	125.293	191.94
637.986	5.31589	82.5664	188.115
638.15	5.17143	135.141	193.37
638.314	5.17143	104.191	193.37
638.478	5.34478	132.555	187.099
638.642	5.3833	136.609	185.76
638.806	5.5759	120.582	179.343
638.97	5.36404	93.1797	186.427
639.134	5.21958	124.977	191.586
639.298	5.36404	108.469	186.427
639.462	5.36404	99.7852	186.427
639.626	5.15217	98.1289	194.093
639.79	5.08476	103.422	196.666
639.954	5.08476	105.723	196.666
640.118	5.05587	99.5586	197.79
640.282	5.02698	139.906	198.927
640.446	5.01735	111.043	199.308
640.61	5.11365	105.813	195.555
640.774	5.30626	146.461	188.457
640.938	5.11365	149.516	195.555
641.103	5.37367	110.512	186.093
641.267	5.287	122.074	189.143
641.431	5.50849	108.016	181.538
641.595	5.46997	90.4844	182.816
641.759	5.44108	116.957	183.787
641.923	5.5759	111.703	179.343
642.087	5.4796	102.695	182.495
642.251	5.41219	124.102	184.768
642.415	5.60479	76.5273	178.419
642.579	5.60479	99.5273	178.419
642.743	5.66257	116.387	176.598
642.907	5.62405	97.6094	177.808
643.071	5.7685	88.9922	173.355
643.235	5.70109	124.355	175.405
643.399	5.62405	93.0039	177.808
643.563	5.50849	87.5977	181.538
643.727	5.3833	119.684	185.76
643.891	5.46997	120.645	182.816
644.055	5.41219	91.75	184.768
644.219	5.31589	122.727	188.115
644.383	5.3833	96.3203	185.76
644.547	5.40256	101.918	185.098
644.711	5.37367	113.621	186.093
644.875	5.36404	99.1406	186.427
645.04	5.27737	115.91	189.488
645.204	5.11365	105.031	195.555
645.368	4.75734	82.1406	210.202
645.532	4.56473	110.508	219.071
645.696	4.09286	119.453	244.328
645.86	4.12175	87.8945	242.616
646.024	3.84247	113.441	260.249
646.188	4.05434	111.313	246.65
646.352	4.06397	94.1445	246.065
646.516	4.02545	97.2734	248.42
646.68	4.61288	136.906	216.784
646.844	5.0655	89.1406	197.414
647.008	5.26774	115.035	189.835
647.172	5.287	92.25	189.143
647.336	5.49886	116.52	181.856
647.5	5.5759	137.609	179.343
647.664	5.62405	111.219	177.808
647.828	5.49886	84.4375	181.856
647.992	5.52775	153.547	180.905

648.156	5.287	95.2031	189.143
648.32	5.17143	122.406	193.37
648.484	4.98846	139.313	200.463
648.648	4.66104	122.953	214.545
648.812	4.8729	136.125	205.217
648.976	5.02698	90.4336	198.927
649.141	5.15217	105.125	194.093
649.305	5.20995	109.875	191.94
649.469	5.40256	104.488	185.098
649.633	5.41219	96.7227	184.768
649.797	5.27737	90.5898	189.488
649.961	5.14254	115.898	194.456
650.125	5.11365	94.3008	195.555
650.289	5.08476	73.8672	196.666
650.453	4.99809	133.93	200.076
650.617	5.12328	97.7656	195.187
650.781	5.09439	117.156	196.294
650.945	5.04624	145.797	198.167
651.109	5.30626	109.078	188.457
651.273	5.11365	115.574	195.555
651.437	5.14254	119.008	194.456
651.601	4.98846	104.867	200.463
651.765	5.04624	96.1758	198.167
651.929	5.09439	82.2617	196.294
652.093	5.0655	122.477	197.414
652.257	5.09439	83.4023	196.294
652.421	4.92105	108.727	203.209
652.585	5.09439	94.125	196.294
652.749	5.02698	104.996	198.927
652.913	4.79586	121.984	208.513
653.077	4.9692	119.129	201.24
653.242	4.9692	101.504	201.24
653.406	5.14254	87.6094	194.456
653.57	5.21958	85.2969	191.586
653.734	5.17143	119.141	193.37
653.898	4.90179	110.539	204.007
654.062	4.94994	105.734	202.023
654.226	5.30626	62.9727	188.457
654.39	5.50849	102.785	181.538
654.554	5.55664	137.766	179.965
654.718	5.46997	112.07	182.816
654.882	5.287	119.559	189.143
655.046	5.0655	94.3086	197.414
655.21	4.39139	97.7383	227.718
655.374	4.05434	109.82	246.65
655.538	4.06397	78.1641	246.065
655.702	4.29509	111.023	232.824
655.866	4.54547	163.867	219.999
656.03	4.60325	91.1836	217.238
656.194	5.08476	99.1289	196.666
656.358	5.21958	118.441	191.586
656.522	5.12328	106.445	195.187
656.686	4.9692	101.719	201.24
656.85	4.92105	98.8672	203.209
657.014	4.79586	136.141	208.513
657.178	4.38176	104.711	228.219
657.343	3.59209	104.801	278.39
657.507	2.87946	110.43	347.288
657.671	2.97576	119.168	336.049
657.835	3.38986	95.9961	294.998
657.999	3.57283	91.082	279.89
658.163	3.78469	110.781	264.222
658.327	4.27583	82.5234	233.873
658.491	4.38176	91.375	228.219
658.655	4.13138	131.789	242.05
658.819	4.18916	96.8945	238.711
658.983	3.90025	110.832	256.394
659.147	3.87136	117.012	258.307

659.311	4.09286	114	244.328
659.475	4.29509	118.176	232.824
659.639	4.37213	127.898	228.721
659.803	4.41065	107.746	226.724
659.967	4.03508	102.121	247.827
660.131	4.02545	108.434	248.42
660.295	4.43954	155.117	225.248
660.459	4.61288	90.5234	216.784
660.623	4.66104	103.605	214.545
660.787	4.95957	147.313	201.63
660.951	4.75734	102.672	210.202
661.115	4.37213	147.422	228.721
661.279	3.55357	133.063	281.407
661.444	3.39949	105.266	294.162
661.608	3.22614	141.727	309.968
661.772	2.86983	127.242	348.453
661.936	2.87946	111.18	347.288
662.1	3.52468	110.988	283.714
662.264	4.24694	107.875	235.464
662.428	4.15064	116.609	240.927
662.592	4.0736	143.281	245.483
662.756	4.00619	105.395	249.614
662.92	3.92914	111.352	254.508
663.084	3.84247	106.074	260.249
663.248	3.77506	121.914	264.896
663.412	3.76543	116.371	265.574
663.576	3.87136	80.3203	258.307
663.74	3.96766	103.785	252.037
663.904	3.92914	127.785	254.508
664.068	4.21805	116.855	237.076
664.232	4.03508	99.9805	247.827
664.396	4.06397	140.469	246.065
664.56	4.34324	107.664	230.243
664.724	4.42028	98.0977	226.23
664.888	4.43954	131.594	225.248
665.052	4.25657	121.719	234.931
665.216	4.39139	121.727	227.718
665.381	4.37213	99.0703	228.721
665.545	4.44917	115.984	224.761
665.709	4.43954	110.199	225.248
665.873	4.10249	105.047	243.755
666.037	4.17953	102.398	239.261
666.201	4.17953	102.164	239.261
666.365	4.13138	102.691	242.05
666.529	4.53584	99.6328	220.466
666.693	4.35287	133.273	229.733
666.857	4.48769	153.586	222.832
667.021	4.47806	122.773	223.311
667.185	4.41065	91.1563	226.724
667.349	4.35287	148.227	229.733
667.513	4.31435	99.957	231.785
667.677	4.19879	88.7148	238.164
667.841	3.97729	126.949	251.427
668.005	3.71728	136.93	269.014
668.169	3.67876	76.4023	271.831
668.333	3.76543	141.492	265.574
668.497	3.68839	131.859	271.121
668.661	3.96766	116.457	252.037
668.825	4.06397	122.02	246.065
668.989	4.09286	85.832	244.328
669.153	3.81358	124.395	262.221
669.317	3.81358	125.227	262.221
669.482	3.80395	96.6055	262.884
669.646	3.86173	130.219	258.951
669.81	3.62098	82.1133	276.168
669.974	3.62098	119.191	276.168
670.138	3.86173	110.207	258.951
670.302	3.66913	96.4805	272.544

670.466	3.64987	150.492	273.982
670.63	3.68839	124.992	271.121
670.794	3.70765	128.133	269.713
670.958	3.51505	119.688	284.491
671.122	3.61135	124.828	276.905
671.286	3.83284	108.031	260.903
671.45	3.99656	91.4414	250.215
671.614	3.92914	108.449	254.508
671.778	4.00619	102.641	249.614
671.942	4.03508	130.039	247.827
672.106	3.92914	116.027	254.508
672.27	4.00619	133.727	249.614
672.434	4.0736	105.434	245.483
672.598	4.16027	85.2422	240.369
672.762	4.24694	123.348	235.464
672.926	4.17953	98.6563	239.261
673.09	4.0736	131.977	245.483
673.254	4.21805	102.422	237.076
673.418	4.18916	115.988	238.711
673.583	4.29509	96.1016	232.824
673.747	4.50695	139.414	221.879
673.911	4.34324	127.391	230.243
674.075	4.31435	87.8281	231.785
674.239	4.38176	119.52	228.219
674.403	4.31435	124.711	231.785
674.567	4.29509	124.566	232.824
674.731	4.48769	111.285	222.832
674.895	4.64178	134.383	215.435
675.059	4.56473	94.0625	219.071
675.223	4.37213	139.906	228.721
675.387	4.61288	116.895	216.784
675.551	4.58399	125.398	218.15
675.715	4.47806	134.102	223.311
675.879	4.44917	126.227	224.761
676.043	4.29509	141.328	232.824
676.207	4.44917	98.2266	224.761
676.371	4.63215	137.508	215.883
676.535	4.60325	108.367	217.238
676.699	4.51658	122.707	221.406
676.863	4.76697	146.164	209.777
677.027	4.56473	133.352	219.071
677.191	4.44917	100.645	224.761
677.355	4.43954	93.6914	225.248
677.519	4.35287	118.578	229.733
677.684	4.25657	105.016	234.931
677.848	4.17953	116.547	239.261
678.012	4.28546	59.4199	233.347
678.176	4.09286	124.945	244.328
678.34	3.93877	99.4102	253.886
678.504	3.95803	130.609	252.651
678.668	3.62098	152.938	276.168
678.832	3.57283	113.727	279.89
678.996	3.39949	104.496	294.162
679.16	3.54394	131.094	282.172
679.324	3.67876	108.383	271.831
679.488	3.64024	116.527	274.707
679.652	3.66913	165.164	272.544
679.816	3.84247	148.797	260.249
679.98	3.64024	102.711	274.707
680.144	3.41875	132.531	292.505
680.308	3.66913	98.3828	272.544
680.472	3.58246	107.676	279.138
680.636	3.55357	119.816	281.407
680.8	3.54394	122.383	282.172
680.964	3.73654	117.117	267.627
681.128	3.88099	128.484	257.666
681.292	4.22768	95.0156	236.536
681.456	4.22768	102.918	236.536

681.621	4.34324	114.016	230.243
681.785	4.17953	130.578	239.261
681.949	3.87136	122.125	258.307
682.113	3.83284	120.012	260.903
682.277	3.54394	93.918	282.172
682.441	3.42838	116.313	291.683
682.605	3.41875	105.59	292.505
682.769	3.84247	82.3945	260.249
682.933	4.02545	101.934	248.42
683.097	4.31435	121.766	231.785
683.261	4.35287	108.418	229.733
683.425	4.41065	105.398	226.724
683.589	4.67067	142.75	214.102
683.753	4.03508	143.258	247.827
683.917	4.17953	105.707	239.261
684.081	3.88099	116.723	257.666
684.245	3.35134	114.543	298.389
684.409	3.07206	152.938	325.514
684.573	3.22614	110.578	309.968
684.737	3.68839	107.953	271.121
684.901	3.90025	131.75	256.394
685.065	4.42028	105.066	226.23
685.229	4.7766	122.473	209.354
685.393	4.6803	133.422	213.662
685.557	4.48769	132.297	222.832
685.722	3.88099	117.074	257.666
685.886	3.33207	124.543	300.113
686.05	3.13947	151.211	318.525
686.214	3.15873	113.973	316.583
686.378	3.23577	105.02	309.045
686.542	3.49579	110.824	286.059
686.706	3.62098	133.414	276.168
686.87	3.45727	110.625	289.246
687.034	3.03354	136.477	329.648
687.198	2.88909	164.891	346.13
687.362	2.40758	105.266	415.355
687.526	2.01274	148.313	496.834
687.69	2.01274	125.93	496.834
687.854	2.61944	91.5625	381.76
688.018	2.08979	140.422	478.518
688.182	2.31128	143.047	432.661
688.346	2.88909	120.293	346.13
688.51	2.45573	129.422	407.211
688.674	1.72384	142.023	580.1
688.838	2.20535	108.715	453.443
689.002	2.36906	120.324	422.108
689.166	2.21498	137.258	451.472
689.33	2.31128	116.867	432.661
689.494	2.08979	133.945	478.518
689.658	1.20381	124.535	830.695
689.823	1.02084	94.4023	979.587
689.987	1.03047	96.5469	970.432
690.151	0.828236	126.215	1207.39
690.315	1.27122	105.586	786.644
690.479	1.84903	99.6172	540.824
690.643	1.46383	128.227	683.141
690.807	0.895647	121.609	1116.51
690.971	0.799345	120.891	1251.02
691.135	1.07862	104.965	927.111
691.299	1.25196	118.879	798.746
691.463	2.23424	128.227	447.58
691.627	2.30165	148.523	434.471
691.791	2.08016	102.898	480.733
691.955	1.05936	145.102	943.967
692.119	1.51198	97.4492	661.386
692.283	1.53124	91.7188	653.067
692.447	1.72384	114.262	580.1
692.611	2.52314	106.32	396.331

692.775	2.60018	150.039	384.588
692.939	2.61944	157.406	381.76
693.103	2.72538	93.1406	366.922
693.267	2.67722	105.109	373.521
693.431	2.24387	146.625	445.659
693.595	2.72538	116.711	366.922
693.759	3.11058	127.203	321.483
693.924	3.26466	120.957	306.31
694.088	3.58246	110.988	279.138
694.252	3.35134	136.156	298.389
694.416	3.12984	116.918	319.505
694.58	3.18762	105.41	313.713
694.744	3.54394	105.086	282.172
694.908	3.62098	104.547	276.168
695.072	3.73654	118.949	267.627
695.236	3.64987	107.758	273.982
695.4	4.17953	101.797	239.261
695.564	4.10249	117.594	243.755
695.728	4.13138	152.414	242.05
695.892	3.95803	139.789	252.651
696.056	3.99656	122.813	250.215
696.22	3.70765	106.086	269.713
696.384	3.80395	122.906	262.884
696.548	4.03508	117.152	247.827
696.712	3.74617	112.492	266.939
696.876	3.49579	138.305	286.059
697.04	3.64024	87	274.707
697.204	3.35134	148.313	298.389
697.368	3.93877	134.289	253.886
697.532	4.6803	126.316	213.662
697.696	4.64178	116.488	215.435
697.861	4.93068	139.234	202.812
698.025	5.56627	109.676	179.654
698.189	6.00926	113.711	166.41
698.353	5.53738	124.953	180.591
698.517	5.60479	116.469	178.419
698.681	5.82628	113.598	171.636
698.845	5.89369	113.531	169.673
699.009	5.8648	118.949	170.509
699.173	6.11519	150.328	163.527
699.337	5.95148	93.2617	168.026
699.501	5.99	139.164	166.945
699.665	6.35594	122.305	157.333
699.829	6.61596	125.711	151.15
699.993	7.12635	122.672	140.324
700.157	6.91449	97.4883	144.624
700.321	6.4715	129.023	154.524
700.485	6.71226	122.406	148.981
700.649	5.79739	117.336	172.491
700.813	5.60479	111.754	178.419
700.977	6.64485	157.914	150.493
701.141	6.71226	156.313	148.981
701.305	6.7893	119.605	147.291
701.469	6.71226	105.055	148.981
701.633	6.75078	137.117	148.131
701.797	6.72189	125.664	148.768
701.962	6.61596	162.828	151.15
702.126	6.39446	150.844	156.385
702.29	6.30779	149.266	158.534
702.454	6.29816	108.352	158.777
702.618	6.04778	82.7031	165.35
702.782	6.32705	85.2227	158.052
702.946	6.75078	127.652	148.131
703.11	6.64485	105.105	150.493
703.274	6.9819	107.684	143.227
703.438	6.83745	105.066	146.253
703.602	6.52928	116.996	153.156
703.766	6.68337	110.523	149.625

703.93	6.58707	114.328	151.813
704.094	6.50039	122.855	153.837
704.258	6.3752	146.445	156.858
704.422	5.88406	112.039	169.951
704.586	5.72998	113.844	174.521
704.75	5.37367	131.297	186.093
704.914	5.53738	93.5195	180.591
705.078	5.52775	128.492	180.905
705.242	5.3833	118.465	185.76
705.406	5.37367	119.18	186.093
705.57	5.287	136.867	189.143
705.734	5.04624	119.914	198.167
705.898	4.63215	102.691	215.883
706.063	4.38176	148.57	228.219
706.227	4.58399	116.027	218.15
706.391	5.26774	88.9297	189.835
706.555	5.09439	125.5	196.294
706.719	5.14254	113.82	194.456
706.883	5.3833	126.902	185.76
707.047	5.44108	113.523	183.787
707.211	5.56627	130.352	179.654
707.375	5.79739	127.383	172.491
707.539	6.13445	128.398	163.014
707.703	6.52928	127.742	153.156
707.867	6.76041	88.0469	147.92
708.031	6.56781	97.125	152.258
708.195	6.10556	108.59	163.785
708.359	6.11519	147.953	163.527
708.523	5.84554	106.301	171.07
708.687	5.3833	134.492	185.76
708.851	5.56627	133.609	179.654
709.015	6.49076	139.672	154.065
709.179	6.93375	120.543	144.222
709.343	6.4715	95.125	154.524
709.507	6.58707	127.863	151.813
709.671	6.36557	128.852	157.095
709.835	6.77967	108.563	147.5
709.999	7.35748	105.633	135.916
710.164	7.26118	125.449	137.719
710.328	7.2034	137.438	138.823
710.492	7.71379	112.73	129.638
710.656	7.64638	97.0664	130.781
710.82	7.60786	127.785	131.443
710.984	7.93529	108.082	126.019
711.148	6.75078	139.344	148.131
711.312	6.52928	121.953	153.156
711.476	7.03005	113.316	142.246
711.64	7.03005	107.723	142.246
711.804	8.07011	124.906	123.914
711.968	9.27388	130.547	107.83
712.132	9.2161	117.34	108.506
712.296	7.80046	145.172	128.197
712.46	7.81009	114.359	128.039
712.624	6.72189	97.1172	148.768
712.788	6.55818	140.094	152.481
712.952	7.99307	128.047	125.108
713.116	8.9946	85.9336	111.178
713.28	9.02349	96.9609	110.822
713.444	8.85978	126.484	112.87
713.608	8.84052	124.219	113.116
713.772	8.31086	119.551	120.324
713.936	7.52119	96.625	132.958
714.101	6.50039	105.656	153.837
714.265	7.9064	102.836	126.48
714.429	7.75231	114.301	128.994
714.593	6.9819	153.336	143.227
714.757	8.12789	105.586	123.033
714.921	8.24345	139.008	121.308

715.085	6.9819	116.051	143.227
715.249	7.41526	87.8633	134.857
715.413	8.9946	113.676	111.178
715.577	8.2916	91.0078	120.604
715.741	8.44568	102.215	118.404
715.905	8.73459	93.8945	114.487
716.069	8.50347	139.344	117.599
716.233	7.31896	128.68	136.631
716.397	7.36711	114.613	135.738
716.561	7.52119	126.449	132.958
716.725	7.48267	134.922	133.642
716.889	8.16641	142	122.453
717.053	7.9064	133.875	126.48
717.217	8.82126	148.875	113.362
717.381	8.43605	134.156	118.539
717.545	8.6094	141.539	116.152
717.709	8.82126	153.375	113.362
717.873	9.56278	137.336	104.572
718.037	8.21456	119.805	121.735
718.202	8.1953	140.445	122.021
718.366	8.099	108.496	123.472
718.53	8.13752	105.629	122.888
718.694	7.31896	141.539	136.631
718.858	8.03159	125.652	124.508
719.022	9.02349	99.5	110.822
719.186	8.66718	135.922	115.378
719.35	8.32049	127.305	120.185
719.514	8.77311	111.012	113.985
719.678	8.69607	102.527	114.994
719.842	8.50347	136.414	117.599
720.006	8.40716	116.711	118.946
720.17	7.97381	138.922	125.411
720.334	8.57088	122.258	116.674
720.498	8.47457	122.684	118
720.662	8.64792	145.648	115.635
720.826	9.30277	99.9219	107.495
720.99	9.27388	117.023	107.83
721.154	8.0027	145.82	124.958
721.318	8.63829	154.375	115.764
721.482	10.0732	99.6602	99.2735
721.646	8.62866	112	115.893
721.81	7.92566	124.516	126.173
721.974	8.6094	106.98	116.152
722.138	9.05238	146.133	110.468
722.303	8.83089	132.141	113.239
722.467	8.47457	108.285	118
722.631	8.59977	134.789	116.282
722.795	9.12943	136.563	109.536
722.959	7.96418	95.0938	125.562
723.123	7.51156	119.867	133.128
723.287	8.0027	104.957	124.958
723.451	8.96571	108.547	111.536
723.615	7.63675	114.063	130.946
723.779	7.45378	155.25	134.16
723.943	8.32049	102.906	120.185
724.107	9.25462	82.6719	108.054
724.271	8.73459	116.973	114.487
724.435	8.21456	128.336	121.735
724.599	10.208	125.137	97.9624
724.763	9.95762	105.664	100.426
724.927	9.2161	111.492	108.506
725.091	8.40716	105.703	118.946
725.255	9.98651	117.418	100.135
725.419	8.74422	116.398	114.361
725.583	7.81009	122.27	128.039
725.747	8.02196	108.613	124.658
725.911	9.63982	138.359	103.736
726.075	8.43605	112.965	118.539

726.239	8.48421	108.539	117.866
726.404	9.71686	149.18	102.914
726.568	9.02349	131.109	110.822
726.732	8.41679	119.824	118.81
726.896	9.01386	157.219	110.94
727.06	9.11016	89.668	109.767
727.224	8.34938	108.781	119.769
727.388	7.94492	116.25	125.867
727.552	8.07011	133.906	123.914
727.716	7.92566	113.711	126.173
727.88	6.90486	139.148	144.826
728.044	6.91449	136.477	144.624
728.208	8.26271	102.328	121.026
728.372	8.45531	131.266	118.269
728.536	7.65601	113.973	130.616
728.7	8.88867	145.359	112.503
728.864	8.9946	118.984	111.178
729.028	7.93529	105.742	126.019
729.192	7.64638	119.773	130.781
729.356	7.93529	100.063	126.019
729.52	7.54045	128.531	132.618
729.684	8.12789	99.9688	123.033
729.848	8.88867	131.406	112.503
730.012	9.14869	103.539	109.305
730.176	9.11016	107.395	109.767
730.341	9.35092	135.484	106.941
730.505	8.93682	158.008	111.897
730.669	8.24345	116.598	121.308
730.833	7.77157	114.418	128.674
730.997	7.63675	128.469	130.946
731.161	8.47457	156.797	118
731.325	8.7057	134.805	114.867
731.489	8.66718	133.477	115.378
731.653	9.02349	171.031	110.822
731.817	9.24499	105.262	108.167
731.981	8.35901	145.148	119.631
732.145	6.3752	108.391	156.858
732.309	6.43298	130.172	155.449
732.473	6.62559	130.508	150.93
732.637	6.23075	113.688	160.494
732.801	6.1826	130.656	161.744
732.965	7.29007	105.289	137.173
733.129	7.99307	187.977	125.108
733.293	8.43605	148.508	118.539
733.457	9.28351	113.887	107.718
733.621	9.02349	148.461	110.822
733.785	8.099	117.465	123.472
733.949	7.35748	114.063	135.916
734.113	6.20186	134.945	161.242
734.277	6.20186	130.281	161.242
734.442	5.92259	139.719	168.845
734.606	4.92105	99.3164	203.209
734.77	4.53584	96.5078	220.466
734.934	5.12328	99.5586	195.187
735.098	4.44917	113.828	224.761
735.262	5.74924	165.711	173.936
735.426	6.00926	112.457	166.41
735.59	4.72845	99.6953	211.486
735.754	3.97729	127.398	251.427
735.918	4.43954	133.648	225.248
736.082	5.04624	136.711	198.167
736.246	2.86983	94.3906	348.453
736.41	2.82168	118.852	354.399
736.574	4.10249	105.238	243.755
736.738	3.99656	159.063	250.215
736.902	2.42684	105.176	412.058
737.066	2.56166	116.801	390.371
737.23	2.90835	115.023	343.838

737.394	2.30165	140.086	434.471
737.558	2.39795	117.348	417.023
737.722	3.76543	123.258	265.574
737.886	3.41875	131.094	292.505
738.05	2.84094	131.656	351.997
738.214	3.67876	118.168	271.831
738.378	3.62098	101.207	276.168
738.543	2.21498	84.0313	451.472
738.707	1.51198	110.902	661.386
738.871	2.58092	122.488	387.458
739.035	0.770455	122.516	1297.93
739.199	0.163756	142.359	6106.67
739.363	1.62754	102.004	614.425
739.527	1.60828	121.906	621.783
739.691	1.44457	79.7969	692.25
739.855	2.90835	113.77	343.838
740.019	3.42838	113.418	291.683
740.183	2.08979	99.7188	478.518
740.347	3.76543	127.605	265.574
740.511	2.46536	122.367	405.62
740.675	1.46383	122.27	683.141
740.839	1.08825	121.824	918.907
741.003	3.80395	110.586	262.884
741.167	1.76236	150.266	567.421
741.331	3.10095	114.105	322.482
741.495	2.96613	94.4297	337.14
741.659	4.12175	117.43	242.616
741.823	1.59865	145.914	625.529
741.987	2.36906	151.25	422.108
742.151	2.82168	126.008	354.399
742.315	2.75427	125.914	363.073
742.479	2.11868	109.188	471.993
742.644	2.85057	133.078	350.807
742.808	3.92914	90.5156	254.508
742.972	4.34324	107.469	230.243
743.136	3.12984	148.703	319.505
743.3	2.52314	133.906	396.331
743.464	2.72538	120.137	366.922
743.628	2.85057	104.938	350.807
743.792	2.24387	117.457	445.659
743.956	2.94687	154.266	339.343
744.12	4.10249	102.816	243.755
744.284	4.51658	128.125	221.406
744.448	4.67067	127.539	214.102
744.612	4.92105	96.5938	203.209
744.776	4.85364	102.527	206.031
744.94	5.12328	101.941	195.187
745.104	5.14254	119.43	194.456
745.268	5.43145	113.414	184.113
745.432	5.33515	136.727	187.436
745.596	4.98846	122.648	200.463
745.76	4.90179	106.027	204.007
745.924	4.82475	134.672	207.265
746.088	5.46997	122.695	182.816
746.252	5.49886	108.293	181.856
746.416	4.98846	145.359	200.463
746.58	5.11365	94.1289	195.555
746.745	4.95957	155.867	201.63
746.909	4.21805	150.602	237.076
747.073	4.63215	127.715	215.883
747.237	5.55664	119.402	179.965
747.401	5.75887	129	173.645
747.565	6.00926	107.883	166.41
747.729	6.51965	136.539	153.382
747.893	6.50039	109.496	153.837
748.057	6.58707	140.016	151.813
748.221	6.7893	82.3555	147.291
748.385	6.77967	127.641	147.5

748.549	7.03968	118.988	142.052
748.713	7.27081	138.734	137.536
748.877	7.93529	118.867	126.019
749.041	7.6849	113.625	130.125
749.205	7.97381	113.738	125.411
749.369	7.99307	130.359	125.108
749.533	9.23536	119.617	108.28
749.697	8.8983	128.266	112.381
749.861	9.75538	119.57	102.507
750.025	10.025	114.262	99.7503
750.189	10.4873	128.641	95.3536
750.353	9.81317	99.8008	101.904
750.517	10.2369	114.516	97.6859
750.682	9.9191	134.141	100.816
750.846	8.31086	98.0898	120.324
751.01	7.5886	130.609	131.777
751.174	7.96418	119.297	125.562
751.338	7.5886	96.4258	131.777
751.502	7.51156	102.023	133.128
751.666	7.96418	143.328	125.562
751.83	8.58051	126.074	116.543
751.994	8.98497	101.004	111.297
752.158	10.1021	140.266	98.9896
752.322	11.2673	154.031	88.7523
752.486	12.0955	133.383	82.6753
752.65	11.0169	107.563	90.7694
752.814	9.6976	127.137	103.118
752.978	10.4006	110.48	96.1483
753.142	11.3347	109.875	88.2244
753.306	10.0828	113.121	99.1787
753.47	10.4873	102.242	95.3536
753.634	11.4888	82.7422	87.0412
753.798	11.5755	71.1289	86.3895
753.962	11.5177	65.7305	86.8229
754.126	11.1999	79.8828	89.2865
754.29	10.2658	80.0039	97.411
754.454	10.9495	82.5938	91.3282
754.618	12.2303	63.0547	81.7639
754.783	11.2384	73.8906	88.9804
754.947	11.0073	80.3398	90.8488
755.111	11.5466	86.4023	86.6056
755.275	11.3347	69.8828	88.2244
755.439	10.8436	72.8789	92.2204
755.603	11.2384	72.7305	88.9804
755.767	11.7681	52.7559	84.9756
755.931	11.6429	79.3125	85.8893
756.095	10.9014	87.0586	91.7316
756.259	10.6125	74.7617	94.2288
756.423	10.5643	85.2891	94.6583
756.587	10.6606	78.7891	93.8032
756.751	10.5162	96.125	95.0917
756.915	10.5547	93.6055	94.7446
757.079	10.1213	102.047	98.8012
757.243	10.391	101.93	96.2374
757.407	9.65908	105.199	103.529
757.571	9.37018	93.2344	106.722
757.735	9.25462	62.748	108.054
757.899	9.18721	57.3848	108.847
758.063	8.48421	94.3086	117.866
758.227	8.53236	71.3594	117.201
758.391	8.96571	94.3867	111.536
758.555	9.24499	97.2031	108.167
758.719	8.22419	74.2734	121.593
758.884	7.7812	91.0625	128.515
759.048	7.73305	109.07	129.315
759.212	7.32859	83.8867	136.452
759.376	7.89677	78.1563	126.634
759.54	8.099	61.2383	123.472

759.704	7.83899	75.7188	127.568
759.868	7.74268	55.248	129.154
760.032	7.74268	76.0742	129.154
760.196	7.51156	102.211	133.128
760.36	7.55008	95.4375	132.449
760.524	7.31896	96.625	136.631
760.688	7.32859	73.3203	136.452
760.852	7.1745	81.8555	139.382
761.016	7.23229	95.8594	138.269
761.18	7.35748	65.2344	135.916
761.344	7.09746	82.2891	140.895
761.508	7.27081	65.207	137.536
761.672	7.23229	101.816	138.269
761.836	7.09746	91.3398	140.895
762	7.80046	90.9258	128.197
762.164	9.2161	85.5078	108.506
762.328	7.35748	80.207	135.916
762.492	7.57897	114.273	131.944
762.656	8.24345	76.9609	121.308
762.82	7.61749	97.0586	131.277
762.985	5.08476	88.3359	196.666
763.149	5.4796	80.1211	182.495
763.313	6.26927	83.3672	159.508
763.477	6.8856	89.7813	145.231
763.641	6.46187	73.2695	154.754
763.805	7.99307	72.6523	125.108
763.969	9.1198	93.3398	109.652
764.133	8.62866	82.0156	115.893
764.297	7.4923	99.6094	133.47
764.461	7.13598	58.1016	140.135
764.625	6.75078	65.7813	148.131
764.789	6.61596	70.9922	151.15
764.953	6.87597	59.3887	145.434
765.117	5.89369	81.6602	169.673
765.281	5.41219	82.1641	184.768
765.445	4.67067	85.3555	214.102
765.609	4.72845	79.4102	211.486
765.773	4.63215	102.809	215.883
765.937	5.24847	62.6895	190.532
766.101	6.65448	79.7773	150.275
766.265	6.8856	88.3281	145.231
766.429	5.94185	71.6016	168.298
766.593	5.98037	68.582	167.214
766.757	6.49076	85.3594	154.065
766.922	7.03005	76.9219	142.246
767.086	6.74115	73.6836	148.343
767.25	6.05741	59.9707	165.087
767.414	5.62405	69.1094	177.808
767.578	5.53738	80.9727	180.591
767.742	5.5759	102.328	179.343
767.906	4.99809	107.891	200.076
768.07	4.93068	64.0859	202.812
768.234	4.63215	55.6523	215.883
768.398	4.22768	108.043	236.536
768.562	4.21805	107.68	237.076
768.726	4.75734	57.5137	210.202
768.89	4.86327	73.7461	205.623
769.054	4.57436	104.563	218.61
769.218	4.39139	56.707	227.718
769.382	3.68839	73.5859	271.121
769.546	3.13947	73.6055	318.525
769.71	3.54394	88.4531	282.172
769.874	4.15064	77	240.927
770.038	4.21805	76.7266	237.076
770.202	4.42028	94.1563	226.23
770.366	4.57436	82.8906	218.61
770.53	4.38176	62.7188	228.219
770.694	4.44917	111.063	224.761

770.858	4.43954	59.9219	225.248
771.023	3.77506	71.3555	264.896
771.187	3.13947	74.0078	318.525
771.351	3.33207	65.9492	300.113
771.515	3.15873	66.375	316.583
771.679	3.19725	75.2227	312.769
771.843	4.35287	67.3086	229.733
772.007	5.40256	76.0469	185.098
772.171	6.00926	75.8828	166.41
772.335	7.14561	55.793	139.946
772.499	7.71379	120.176	129.638
772.663	7.73305	78.9414	129.315
772.827	7.55971	72.1914	132.28
772.991	7.45378	68.2969	134.16
773.155	7.16487	85.0195	139.57
773.319	6.9819	76.6484	143.227
773.483	6.62559	92.5352	150.93
773.647	6.24038	98.1172	160.247
773.811	6.35594	55.8457	157.333
773.975	6.43298	80.5703	155.449
774.139	6.52928	98.0625	153.156
774.303	6.693	89.9219	149.41
774.467	6.81819	73.1641	146.667
774.631	6.66411	93.2031	150.058
774.795	6.45224	50.7441	154.985
774.959	6.58707	93	151.813
775.124	5.8648	36.7773	170.509
775.288	5.46034	70.793	183.139
775.452	5.46997	93.1406	182.816
775.616	5.74924	74.375	173.936
775.78	5.33515	104.137	187.436
775.944	5.46997	81.5938	182.816
776.108	5.19069	76.1211	192.652
776.272	5.287	64.1797	189.143
776.436	5.33515	76.168	187.436
776.6	5.72998	76.3516	174.521
776.764	6.21149	70.0391	160.992
776.928	7.64638	77.9531	130.781
777.092	8.53236	88.6484	117.201
777.256	9.03312	59.2637	110.704
777.42	9.505	90.7031	105.208
777.584	9.97688	79.3047	100.232
777.748	10.0058	72.8984	99.9423
777.912	9.95762	81.4219	100.426
778.076	10.1695	72.7539	98.3334
778.24	10.0443	72.832	99.5591
778.404	9.75538	67.3242	102.507
778.568	9.2161	78.9531	108.506
778.732	9.05238	70.6992	110.468
778.896	9.08127	73.4844	110.117
779.06	9.20647	70.9648	108.619
779.225	9.18721	82.2969	108.847
779.389	8.86941	93.5234	112.747
779.553	8.64792	62.3496	115.635
779.717	8.07011	68.3789	123.914
779.881	7.48267	80.9727	133.642
780.045	7.57897	64.2813	131.944
780.209	7.2034	99.582	138.823
780.373	7.32859	69.9414	136.452
780.537	7.26118	104.641	137.719
780.701	6.64485	67.2383	150.493
780.865	6.55818	67.2148	152.481
781.029	6.46187	69.4922	154.754
781.193	6.42335	71.8477	155.682
781.357	6.68337	88.1758	149.625
781.521	7.03968	92.9258	142.052
781.685	7.23229	76.2656	138.269
781.849	7.82935	73.2031	127.724

782.013	7.92566	84.1445	126.173
782.177	8.06048	78.7383	124.062
782.341	8.37827	86.6836	119.356
782.505	8.25308	84.0703	121.167
782.669	8.22419	75.9258	121.593
782.833	8.54199	81.6719	117.069
782.997	8.35901	70.5469	119.631
783.162	8.06048	93.8438	124.062
783.326	8.099	73.918	123.472
783.49	8.15678	65.2734	122.597
783.654	8.45531	85.0703	118.269
783.818	8.41679	65.3398	118.81
783.982	8.91756	71.9141	112.138
784.146	8.79237	113.73	113.735
784.31	8.62866	105.711	115.893
784.474	8.53236	99.2031	117.201
784.638	8.26271	75.4688	121.026
784.802	8.26271	78.7148	121.026
784.966	8.099	87.9727	123.472
785.13	7.80046	105.281	128.197
785.294	7.75231	86.5156	128.994
785.458	7.70416	94.3867	129.8
785.458	8.02196	87.207	124.658
785.458	7.96418	88.5313	125.562
785.458	8.07011	84.0977	123.914
785.458	8.0027	74.0586	124.958
785.458	7.94492	84.0977	125.867
785.458	7.97381	66.3906	125.411
785.458	8.07011	76.2695	123.914
785.458	7.99307	84.0977	125.108
785.458	8.02196	85.2031	124.658
785.458	7.94492	88.4297	125.867
785.458	7.97381	87.418	125.411
785.458	7.86788	89.6328	127.099
785.458	7.89677	58.584	126.634
785.458	7.82935	98.4805	127.724
	Conductivity	Natural Gamma	Resistivity
785.458	7.93529	73.0352	126.019
785.294	7.9064	91.6914	126.48
785.13	8.0027	88.4453	124.958
784.966	8.04122	91.0859	124.359
784.802	7.94492	82.0625	125.867
784.638	7.87751	63.5723	126.944
784.474	7.89677	88.9531	126.634
784.31	8.11826	64.6016	123.179
784.146	8.22419	93.6484	121.593
783.982	8.11826	95.1719	123.179
783.818	7.9064	65.4844	126.48
783.654	7.73305	75.2578	129.315
783.49	7.42489	81.457	134.682
783.326	7.03968	74.6406	142.052
783.162	6.80856	83.1133	146.874
782.997	6.90486	90.2109	144.826
782.833	6.74115	83.3711	148.343
782.669	6.56781	75.8906	152.258
782.505	6.29816	69.0859	158.777
782.341	5.88406	67.8164	169.951
782.177	5.26774	91.1719	189.835
782.013	4.54547	76.7656	219.999
781.849	4.29509	83.4102	232.824
781.685	4.32398	83.3359	231.268
781.521	4.24694	80.4531	235.464
781.357	3.62098	83.4492	276.168
781.193	3.55357	94.3867	281.407
781.029	3.28392	92.1914	304.514
780.865	2.96613	69.0508	337.14
780.701	2.91798	99.8242	342.703
780.537	2.74464	106.25	364.347

780.373	2.72538	77.9219	366.922
780.209	3.00465	72.418	332.817
780.045	3.45727	71.5664	289.246
779.881	3.42838	89.0195	291.683
779.717	3.61135	75.457	276.905
779.553	4.22768	64.8438	236.536
779.389	4.42028	67.4609	226.23
779.225	4.39139	77.1758	227.718
779.06	5.0655	74.4609	197.414
778.896	4.9692	80.707	201.24
778.732	5.05587	74.0742	197.79
778.568	5.21958	103.309	191.586
778.404	4.76697	78.6719	209.777
778.24	4.06397	66.0703	246.065
778.076	3.54394	70.375	282.172
777.912	3.64987	79.4766	273.982
777.748	3.36097	69.3945	297.534
777.584	3.22614	66.9336	309.968
777.42	3.04317	56.1289	328.605
777.256	2.90835	70.1914	343.838
777.092	2.46536	70.5977	405.62
776.928	1.59865	64.9219	625.529
776.764	0.905277	65.7266	1104.63
776.6	-0.0384776	82.2266	-25989.1
776.436	-1.37707	59.498	-726.18
776.272	-2.81196	73.2813	-355.624
776.108	-3.41866	107.137	-292.512
775.944	-3.87128	69.1875	-258.313
775.78	-3.44755	52.5469	-290.061
775.616	-2.49417	66.0117	-400.936
775.452	-2.43638	94.3477	-410.444
775.288	-2.26304	89.5195	-441.883
775.124	-2.2823	79.1758	-438.154
774.959	-2.27267	84.918	-440.011
774.795	-2.34008	95.1406	-427.335
774.631	-1.92599	73.7656	-519.214
774.467	-1.44448	77.0977	-692.291
774.303	-1.46374	86.6211	-683.182
774.139	-1.02075	87.6641	-979.669
773.975	-1.08816	87.3828	-918.979
773.811	-1.43485	85.918	-696.937
773.647	-2.02229	63.3066	-494.489
773.483	-2.17637	79.1484	-459.48
773.319	-2.46528	77.5039	-405.634
773.155	-2.49417	72.8281	-400.936
772.991	-1.95488	72.0234	-511.541
772.827	-1.00149	77.668	-998.51
772.663	0.0289334	80.0898	34562.1
772.499	0.45266	59.2637	2209.16
772.335	0.924537	76.8242	1081.62
772.171	1.30011	67.7773	769.164
772.007	0.606742	67.6484	1648.15
771.843	-0.250341	83.1367	-3994.55
771.679	-0.885931	79.2383	-1128.76
771.515	-1.56967	70.4922	-637.076
771.351	-2.20526	83.0977	-453.461
771.187	-2.07044	88.0898	-482.989
771.023	-1.1941	87.875	-837.454
770.858	-0.82815	73.4492	-1207.51
770.694	0.0867143	81.4258	11532.1
770.53	1.14603	80.2891	872.577
770.366	2.08016	75.4727	480.733
770.202	2.75427	84.4258	363.073
770.038	3.32244	74.6992	300.983
769.874	3.80395	81.1602	262.884
769.71	4.03508	75.6602	247.827
769.546	4.10249	99.2539	243.755
769.382	4.47806	82.707	223.311

769.218	4.64178	59.375	215.435
769.054	4.73808	90.8594	211.056
768.89	5.34478	102.109	187.099
768.726	5.55664	80.7461	179.965
768.562	5.17143	71.4766	193.37
768.398	5.4796	76.3906	182.495
768.234	5.69146	83.5508	175.702
768.07	5.74924	83.5273	173.936
767.906	5.52775	67.2852	180.905
767.742	6.23075	78.2422	160.494
767.578	6.10556	58.9219	163.785
767.414	6.23075	80.3789	160.494
767.25	6.76041	83.3398	147.92
767.086	7.09746	85.2188	140.895
766.922	7.35748	71.832	135.916
766.757	7.34785	77.7305	136.094
766.593	6.75078	89.5703	148.131
766.429	6.42335	85.0977	155.682
766.265	6.43298	100.035	155.449
766.101	6.26927	90.1797	159.508
765.937	6.33668	71.6602	157.811
765.773	6.14408	93.9375	162.758
765.609	6.0863	75.6055	164.303
765.445	5.33515	81.5352	187.436
765.281	5.19069	81.0039	192.652
765.117	4.95957	76.2344	201.63
764.953	5.12328	48.4219	195.187
764.789	5.69146	87.8438	175.702
764.625	6.91449	76.6758	144.624
764.461	7.70416	89.6094	129.8
764.297	7.00116	78.1641	142.833
764.133	6.36557	95.6211	157.095
763.969	6.68337	54.9121	149.625
763.805	6.58707	67.2852	151.813
763.641	6.46187	89.0313	154.754
763.477	6.94338	87.7969	144.022
763.313	7.22266	52.5078	138.453
763.149	7.12635	83.4883	140.324
762.985	6.7893	42.0371	147.291
762.82	7.64638	86.7539	130.781
762.656	6.43298	79.5586	155.449
762.492	5.98037	75.1836	167.214
762.328	6.50039	68.7422	153.837
762.164	7.09746	70.3516	140.895
762	6.0863	78.1289	164.303
761.836	6.84708	79.6445	146.048
761.672	7.13598	87.6211	140.135
761.508	6.94338	76.3828	144.022
761.344	6.85671	93.6719	145.843
761.18	6.62559	98.2813	150.93
761.016	6.62559	83.4492	150.93
760.852	6.4715	88.4414	154.524
760.688	6.2789	52.8906	159.264
760.524	6.42335	62.4531	155.682
760.36	6.83745	93.3672	146.253
760.196	6.93375	86.4688	144.222
760.032	6.65448	74.2813	150.275
759.868	6.55818	65.7344	152.481
759.704	7.04931	80.4023	141.858
759.54	7.03005	79.2578	142.246
759.376	6.94338	92.7188	144.022
759.212	6.83745	85.5156	146.253
759.048	6.52928	82.2266	153.156
758.884	6.26927	85.0352	159.508
758.719	6.50039	99.0977	153.837
758.555	7.26118	86.6641	137.719
758.391	7.82935	67.832	127.724
758.227	7.70416	73.9141	129.8

758.063	7.89677	71.9336	126.634
757.899	8.62866	92.9961	115.893
757.735	8.63829	81.0391	115.764
757.571	8.802	80.3594	113.611
757.407	8.79237	84.4883	113.735
757.243	8.84052	75.5273	113.116
757.079	8.88867	62.541	112.503
756.915	9.12943	87.2344	109.536
756.751	9.2161	61.9824	108.506
756.587	9.90947	67.8398	100.914
756.423	9.78428	61.9277	102.205
756.259	10.3043	67.1094	97.0468
756.095	10.0732	82.0234	99.2735
755.931	10.7088	73.1641	93.3814
755.767	10.8725	73.1953	91.9753
755.603	11.1421	81.3477	89.7495
755.439	11.1614	81.2891	89.5946
755.275	11.0651	90.207	90.3744
755.111	10.7088	59.5117	93.3814
754.947	10.8821	90.0234	91.8939
754.783	10.8436	86.7969	92.2204
754.618	11.5273	86.7773	86.7503
754.454	11.0169	81.8242	90.7694
754.29	11.5562	62.8555	86.5335
754.126	11.5081	106.156	86.8955
753.962	10.9206	82.0469	91.5698
753.798	10.8436	88.6445	92.2204
753.634	10.6799	82.0938	93.634
753.47	10.2658	115.262	97.411
753.306	10.5547	95.4766	94.7446
753.142	11.7777	126.672	84.9061
752.978	10.5932	127.125	94.4001
752.814	10.3428	82.125	96.6854
752.65	10.5643	105.137	94.6583
752.486	11.0073	109.574	90.8488
752.322	10.911	109.199	91.6506
752.158	10.8436	119.414	92.2204
751.994	11.0169	114.32	90.7694
751.83	10.1695	124.188	98.3334
751.666	9.71686	130.414	102.914
751.502	10.0058	120.012	99.9423
751.338	9.68797	129.117	103.221
751.174	9.24499	105.93	108.167
751.01	9.37981	126.027	106.612
750.846	10.7762	104.762	92.7973
750.682	11.1132	112.672	89.9828
750.517	10.8821	139.641	91.8939
750.353	11.2673	116.754	88.7523
750.189	12.057	127.41	82.9394
750.025	11.6525	89.4023	85.8183
749.861	12.134	117.648	82.4128
749.697	11.9703	111.234	83.54
749.533	12.317	124.098	81.1886
749.369	11.1903	112.07	89.3633
749.205	10.9495	118.184	91.3282
749.041	10.4006	117.438	96.1483
748.877	10.3428	129.523	96.6854
748.713	10.1406	127.16	98.6136
748.549	10.1502	114.742	98.52
748.385	10.1021	113.57	98.9896
748.221	10.025	94.8047	99.7503
748.057	10.2465	111.895	97.5941
747.893	10.4391	90.168	95.7935
747.729	10.7184	125.574	93.2975
747.565	10.4295	110.137	95.8819
747.401	9.88058	98.9844	101.209
747.237	9.8228	124.461	101.804
747.073	9.4087	126.043	106.285

746.909	9.43759	113.949	105.959
746.745	9.25462	113.652	108.054
746.58	8.64792	112.887	115.635
746.416	8.92719	122.383	112.017
746.252	9.6013	131.039	104.153
746.088	9.15832	100.363	109.19
745.924	8.6094	122.16	116.152
745.76	8.802	93.1406	113.611
745.596	8.6094	122.473	116.152
745.432	8.6094	116.113	116.152
745.268	8.72496	111.129	114.614
745.104	9.17758	125.945	108.961
744.94	9.95762	97.3828	100.426
744.776	10.4969	134.602	95.2662
744.612	10.8532	135.078	92.1385
744.448	9.90947	116.586	100.914
744.284	9.11016	115.18	109.767
744.12	9.15832	121.883	109.19
743.956	8.84052	116.387	113.116
743.792	8.26271	125.074	121.026
743.628	9.42796	112.727	106.067
743.464	10.5258	111.949	95.0047
743.3	10.468	95.418	95.5291
743.136	10.8051	124.898	92.5491
742.972	11.4118	131.781	87.6288
742.808	10.9014	134.156	91.7316
742.644	8.86941	114.152	112.747
742.479	8.802	98.5	113.611
742.315	9.505	127.273	105.208
742.151	9.05238	121.512	110.468
741.987	8.98497	119.598	111.297
741.823	9.54352	138.375	104.783
741.659	10.5836	119.008	94.486
741.495	8.95608	122.371	111.656
741.331	10.5258	102.387	95.0047
741.167	11.094	127.988	90.139
741.003	12.4422	129.078	80.3717
740.839	10.3332	103.582	96.7755
740.675	11.6718	120.902	85.6767
740.511	11.1903	107.484	89.3633
740.347	11.1132	118.84	89.9828
740.183	10.4295	139.93	95.8819
740.019	11.2384	116.332	88.9804
739.855	10.3236	158.414	96.8658
739.691	10.911	123.438	91.6506
739.527	11.2577	112.078	88.8282
739.363	10.0443	114.285	99.5591
739.199	9.25462	124.121	108.054
739.035	10.1502	86.0313	98.52
738.871	10.8532	121.551	92.1385
738.707	9.94799	118.156	100.523
738.543	11.5177	94.4141	86.8229
738.378	12.4711	120.047	80.1855
738.214	11.7103	112.023	85.3949
738.05	10.9399	110.043	91.4086
737.886	11.5755	121.227	86.3895
737.722	10.6606	108.266	93.8032
737.558	9.75538	115.387	102.507
737.394	10.728	119.371	93.2138
737.23	11.1132	120.758	89.9828
737.066	9.94799	137.602	100.523
736.902	9.54352	109.703	104.783
736.738	10.1502	111.066	98.52
736.574	9.24499	114.676	108.167
736.41	9.1198	123.602	109.652
736.246	10.9206	118.234	91.5698
736.082	11.9029	155.609	84.0131
735.918	10.391	115.496	96.2374

735.754	9.73612	123.875	102.71
735.59	10.9495	95.2813	91.3282
735.426	10.1791	117.688	98.2404
735.262	8.85978	124.512	112.87
735.098	8.32049	118.855	120.185
734.934	8.64792	104.172	115.635
734.77	8.16641	137.867	122.453
734.606	8.53236	109.316	117.201
734.442	9.14869	108.277	109.305
734.277	9.37018	130.102	106.722
734.113	9.73612	113.273	102.71
733.949	10.2465	121.668	97.5941
733.785	10.391	103.633	96.2374
733.621	10.2947	112.621	97.1376
733.457	9.49537	129.906	105.314
733.293	8.98497	121.207	111.297
733.129	8.58051	86.3555	116.543
732.965	7.86788	140.977	127.099
732.801	7.38637	130.234	135.385
732.637	7.5886	88.0859	131.777
732.473	7.83899	121.285	127.568
732.309	8.33975	93.1563	119.908
732.145	9.02349	118.801	110.822
731.981	9.88058	106.574	101.209
731.817	9.62056	132.813	103.944
731.653	9.03312	115.906	110.704
731.489	8.59977	151.875	116.282
731.325	8.0027	98.1875	124.958
731.161	7.61749	111.664	131.277
730.997	7.70416	107.078	129.8
730.833	8.63829	102.801	115.764
730.669	8.82126	137.68	113.362
730.505	9.47611	114.465	105.529
730.341	8.8983	89.7383	112.381
730.176	8.7057	118.262	114.867
730.012	8.41679	124.07	118.81
729.848	7.92566	130.203	126.173
729.684	8.02196	102.887	124.658
729.52	8.6094	114.09	116.152
729.356	8.3879	130.539	119.219
729.192	8.54199	104.145	117.069
729.028	8.8983	119.5	112.381
728.864	7.89677	117.508	126.634
728.7	7.34785	91.2578	136.094
728.536	7.27081	116.609	137.536
728.372	7.80046	102.094	128.197
728.208	7.06857	104.801	141.471
728.044	7.31896	101.98	136.631
727.88	7.99307	115.211	125.108
727.716	8.16641	109.707	122.453
727.552	7.26118	116.723	137.719
727.388	7.06857	129.133	141.471
727.224	7.89677	127.266	126.634
727.06	7.4923	118.816	133.47
726.896	7.01079	124.277	142.637
726.732	7.63675	92.2383	130.946
726.568	8.13752	116.223	122.888
726.404	6.93375	125.477	144.222
726.239	7.01079	123.059	142.637
726.075	8.57088	104.809	116.674
725.911	8.82126	130.938	113.362
725.747	7.51156	132.18	133.128
725.583	9.03312	123.734	110.704
725.419	9.97688	102.219	100.232
725.255	8.55162	112.977	116.937
725.091	6.68337	103.238	149.625
724.927	8.64792	118.891	115.635
724.763	8.9946	131.977	111.178

724.599	8.07011	146.641	123.914
724.435	7.14561	101.813	139.946
724.271	8.5131	118.57	117.466
724.107	8.21456	111.586	121.735
723.943	7.82935	118.57	127.724
723.779	7.396	112.848	135.208
723.615	8.0027	134.344	124.958
723.451	8.41679	101.996	118.81
723.287	7.9064	123.828	126.48
723.123	8.47457	102.867	118
722.959	8.45531	113.586	118.269
722.795	7.73305	125.711	129.315
722.631	6.95301	121.051	143.823
722.467	7.2997	129.141	136.992
722.303	7.77157	131.242	128.674
722.138	7.84862	109.367	127.411
721.974	7.55008	125.121	132.449
721.81	7.80046	104.684	128.197
721.646	8.62866	126.484	115.893
721.482	8.77311	102.371	113.985
721.318	7.4923	121.359	133.47
721.154	7.61749	92.1992	131.277
720.99	7.65601	102.102	130.616
720.826	7.81009	108.508	128.039
720.662	8.07011	142.359	123.914
720.498	8.07011	126.477	123.914
720.334	7.89677	109.512	126.634
720.17	8.11826	132.195	123.179
720.006	8.08937	122.461	123.619
719.842	8.0027	99.2773	124.958
719.678	7.80046	107.293	128.197
719.514	7.41526	119.605	134.857
719.35	7.25155	119.441	137.902
719.186	7.36711	118.793	135.738
719.022	7.09746	128.969	140.895
718.858	7.54045	136.672	132.618
718.694	7.92566	124.789	126.173
718.53	8.04122	114.492	124.359
718.366	7.13598	121.828	140.135
718.202	7.06857	100.488	141.471
718.037	7.51156	112.949	133.128
717.873	7.7812	112.313	128.515
717.709	7.14561	114.594	139.946
717.545	7.48267	124.008	133.642
717.381	7.13598	123.398	140.135
717.217	6.7893	118.438	147.291
717.053	6.46187	118.625	154.754
716.889	7.35748	112.676	135.916
716.725	6.55818	132.555	152.481
716.561	6.71226	134.031	148.981
716.397	7.22266	117.961	138.453
716.233	7.65601	150.406	130.616
716.069	6.72189	102.254	148.768
715.905	6.4715	136.563	154.524
715.741	6.4715	126.109	154.524
715.577	6.13445	100.539	163.014
715.413	5.72035	106.988	174.814
715.249	6.03815	110.52	165.614
715.085	7.03968	130.016	142.052
714.921	6.7893	125.086	147.291
714.757	6.24038	118.113	160.247
714.593	6.84708	114.535	146.048
714.429	7.00116	127.563	142.833
714.265	6.07667	118.922	164.564
714.101	6.65448	135.188	150.275
713.936	6.91449	103.34	144.624
713.772	5.40256	111.094	185.098
713.608	5.40256	113.844	185.098

713.444	6.29816	101.855	158.777
713.28	6.01889	133.766	166.144
713.116	5.66257	132.648	176.598
712.952	5.99	103.449	166.945
712.788	6.77967	124.875	147.5
712.624	6.55818	126.008	152.481
712.46	5.72035	123.84	174.814
712.296	5.49886	110.117	181.856
712.132	6.1826	115.152	161.744
711.968	5.53738	142.047	180.591
711.804	4.57436	130.938	218.61
711.64	5.17143	128.563	193.37
711.476	5.34478	122.453	187.099
711.312	5.3833	150.227	185.76
711.148	6.11519	141.203	163.527
710.984	5.46997	130.328	182.816
710.82	5.34478	122.008	187.099
710.656	5.41219	121.578	184.768
710.492	5.78776	121.461	172.778
710.328	5.79739	103.426	172.491
710.164	6.11519	99.9805	163.527
709.999	6.05741	116.152	165.087
709.835	5.70109	114.297	175.405
709.671	5.12328	134.117	195.187
709.507	5.11365	111.09	195.555
709.343	5.0655	135.039	197.414
709.179	4.60325	137.32	217.238
709.015	4.50695	116.012	221.879
708.851	5.18106	137.273	193.011
708.687	5.43145	123.277	184.113
708.523	6.07667	111.637	164.564
708.359	5.99	125.098	166.945
708.195	5.7685	116.016	173.355
708.031	5.89369	107.301	169.673
707.867	5.36404	145.375	186.427
707.703	4.73808	119.422	211.056
707.539	5.19069	128.328	192.652
707.375	5.30626	115.105	188.457
707.211	4.63215	120.164	215.883
707.047	5.37367	123.277	186.093
706.883	6.00926	125.984	166.41
706.719	5.50849	116.828	181.538
706.555	5.26774	106.031	189.835
706.391	5.7685	99.5156	173.355
706.227	5.60479	98.5	178.419
706.063	5.75887	101.824	173.645
705.898	5.4796	130.898	182.495
705.734	5.55664	141.352	179.965
705.57	5.26774	112.082	189.835
705.406	5.20995	111.148	191.94
705.242	5.33515	125.355	187.436
705.078	5.02698	124.914	198.927
704.914	4.83438	125.758	206.852
704.75	4.92105	111.785	203.209
704.586	4.79586	131.781	208.513
704.422	5.05587	115.621	197.79
704.258	4.85364	108.363	206.031
704.094	4.8729	85.7227	205.217
703.93	4.80549	113.973	208.095
703.766	4.63215	110.121	215.883
703.602	4.69956	136.078	212.786
703.438	4.53584	111.082	220.466
703.274	4.34324	127.84	230.243
703.11	4.31435	99.8633	231.785
702.946	4.44917	102.723	224.761
702.782	4.25657	96.2734	234.931
702.618	4.16027	139.047	240.369
702.454	4.13138	98.5703	242.05

702.29	4.0736	113.82	245.483
702.126	3.99656	126.707	250.215
701.962	3.81358	123.566	262.221
701.797	3.70765	126.68	269.713
701.633	3.93877	114.141	253.886
701.469	3.90988	116.594	255.762
701.305	3.48616	112.777	286.849
701.141	3.48616	105.16	286.849
700.977	3.29355	127.742	303.623
700.813	3.35134	121.023	298.389
700.649	3.64024	125.875	274.707
700.485	3.61135	98.2969	276.905
700.321	3.38023	114.207	295.838
700.157	2.98539	128.648	334.965
699.993	2.90835	130.992	343.838
699.829	2.82168	111.559	354.399
699.665	2.88909	106.238	346.13
699.501	2.74464	114.414	364.347
699.337	2.04163	119.617	489.804
699.173	2.24387	120.164	445.659
699.009	2.26313	126.137	441.866
698.845	1.89718	126.082	527.097
698.681	1.89718	113.996	527.097
698.517	2.10905	131.836	474.148
698.353	2.24387	110.305	445.659
698.189	1.99348	116.777	501.634
698.025	2.17646	111.391	459.462
697.861	2.35943	121.102	423.831
697.696	2.71575	145.195	368.223
697.532	2.27276	105.457	439.994
697.368	2.20535	132.086	453.443
697.204	1.75273	120.012	570.538
697.04	1.50235	139.406	665.625
696.876	1.75273	130.648	570.538
696.712	1.60828	116.961	621.783
696.548	1.51198	128.484	661.386
696.384	1.49272	120.902	669.92
696.22	1.97422	127.434	506.528
696.056	2.30165	118.383	434.471
695.892	2.50388	130.555	399.38
695.728	2.68685	112.934	372.182
695.564	2.55203	113.082	391.845
695.4	2.40758	124.867	415.355
695.236	2.40758	136.406	415.355
695.072	2.29202	109.641	436.297
694.908	2.01274	93.9609	496.834
694.744	1.68532	89.7695	593.359
694.58	0.982318	112.512	1018
694.416	0.741565	112.355	1348.5
694.252	1.24233	113.738	804.938
694.088	1.50235	140.75	665.625
693.924	1.20381	118.113	830.695
693.759	1.37715	116.066	726.135
693.595	1.50235	98.7891	665.625
693.431	1.63717	104.898	610.811
693.267	1.33863	148.008	747.03
693.103	1.28085	98.5273	780.73
692.939	1.39641	114.688	716.12
692.775	1.39641	124.668	716.12
692.611	1.11714	110.184	895.143
692.447	1.69495	103.41	589.988
692.283	1.78162	104.742	561.287
692.119	0.645263	107.449	1549.76
691.955	0.799345	116.008	1251.02
691.791	1.00158	111.117	998.424
691.627	0.953428	101.855	1048.85
691.463	0.837866	116.566	1193.51
691.299	0.924537	91.6602	1081.62

691.135	0.712674	122.609	1403.17
690.971	0.0096731	106.93	103379
690.807	0.760825	129.234	1314.36
690.643	1.65643	132.922	603.708
690.479	1.37715	107.758	726.135
690.315	0.905277	97.6172	1104.63
690.151	1.21344	100.527	824.102
689.987	1.53124	126.516	653.067
689.823	1.28085	108.547	780.73
689.658	1.36752	120.129	731.248
689.494	1.75273	152.438	570.538
689.33	1.79125	134.117	558.269
689.166	1.41568	112.043	706.377
689.002	1.89718	141.977	527.097
688.838	2.08979	105.145	478.518
688.674	2.53277	111.441	394.824
688.51	2.42684	129.211	412.058
688.346	1.99348	105.371	501.634
688.182	1.92607	118.047	519.191
688.018	1.92607	122.621	519.191
687.854	1.72384	117.504	580.1
687.69	2.20535	86.2383	453.443
687.526	2.52314	113.547	396.331
687.362	2.59055	147.086	386.018
687.198	2.81205	107.539	355.613
687.034	3.03354	107.637	329.648
686.87	3.42838	98.8008	291.683
686.706	3.71728	121.879	269.014
686.542	3.93877	125.191	253.886
686.378	4.15064	104.199	240.927
686.214	4.18916	119.57	238.711
686.05	4.29509	114.168	232.824
685.886	4.15064	119.461	240.927
685.722	4.05434	122.836	246.65
685.557	3.55357	108.668	281.407
685.393	3.38986	145.914	294.998
685.229	3.28392	116.43	304.514
685.065	3.44764	103.887	290.054
684.901	3.90025	123.074	256.394
684.737	4.22768	112.473	236.536
684.573	4.34324	135.703	230.243
684.409	4.73808	114.301	211.056
684.245	5.18106	122.387	193.011
684.081	4.95957	107.109	201.63
683.917	4.64178	128.289	215.435
683.753	4.58399	126.918	218.15
683.589	4.31435	107.008	231.785
683.425	4.06397	115.375	246.065
683.261	4.38176	95.6367	228.219
683.097	4.17953	109.25	239.261
682.933	4.21805	103.691	237.076
682.769	4.34324	108.746	230.243
682.605	4.17953	121.441	239.261
682.441	4.03508	116.91	247.827
682.277	3.88099	104.617	257.666
682.113	4.05434	104.113	246.65
681.949	4.16027	111.09	240.369
681.785	4.24694	129.805	235.464
681.621	4.31435	128.102	231.785
681.456	4.43954	103.309	225.248
681.292	4.38176	132.219	228.219
681.128	4.43954	117.695	225.248
680.964	4.34324	109.004	230.243
680.8	4.34324	116.449	230.243
680.636	4.37213	93.4922	228.721
680.472	4.15064	104.305	240.927
680.308	4.00619	118.27	249.614
680.144	4.06397	123.242	246.065

679.98	4.10249	101.734	243.755
679.816	4.0736	125.043	245.483
679.652	4.13138	125.672	242.05
679.488	4.15064	119.746	240.927
679.324	4.27583	120.957	233.873
679.16	4.18916	102.148	238.711
678.996	4.03508	113.23	247.827
678.832	4.00619	127.969	249.614
678.668	4.17953	99.4492	239.261
678.504	4.35287	84.4023	229.733
678.34	4.29509	112.582	232.824
678.176	4.35287	129.289	229.733
678.012	4.16027	100.059	240.369
677.848	4.02545	93.9609	248.42
677.684	4.12175	123.164	242.616
677.519	4.13138	125.449	242.05
677.355	4.24694	105.684	235.464
677.191	4.18916	118.281	238.711
677.027	4.22768	127.898	236.536
676.863	4.58399	100.422	218.15
676.699	4.43954	111.57	225.248
676.535	4.15064	126.055	240.927
676.371	3.78469	113.133	264.222
676.207	3.64024	99.3203	274.707
676.043	3.49579	111.184	286.059
675.879	3.47653	92.5547	287.643
675.715	3.58246	104.23	279.138
675.551	3.90025	123.32	256.394
675.387	3.90025	122.438	256.394
675.223	3.73654	128.016	267.627
675.059	3.73654	92.168	267.627
674.895	3.81358	114.918	262.221
674.731	3.86173	121.777	258.951
674.567	3.95803	123.867	252.651
674.403	3.95803	131.641	252.651
674.239	3.90025	97.6445	256.394
674.075	3.78469	133.305	264.222
673.911	3.77506	119.125	264.896
673.747	3.87136	112.168	258.307
673.583	3.95803	132.008	252.651
673.418	3.84247	115.34	260.249
673.254	3.83284	128.789	260.903
673.09	3.71728	91.6016	269.014
672.926	3.73654	117.598	267.627
672.762	3.84247	124.605	260.249
672.598	3.90025	112.063	256.394
672.434	3.84247	104.316	260.249
672.27	3.66913	118.867	272.544
672.106	3.80395	105.121	262.884
671.942	3.80395	98.1523	262.884
671.778	3.83284	96.0078	260.903
671.614	3.67876	117.066	271.831
671.45	3.58246	93.0352	279.138
671.286	3.41875	114.363	292.505
671.122	3.12984	128.938	319.505
670.958	3.04317	96.3008	328.605
670.794	3.20688	118.383	311.829
670.63	3.36097	135.398	297.534
670.466	3.55357	120.492	281.407
670.302	3.61135	106.586	276.905
670.138	3.55357	104.164	281.407
669.974	3.74617	121.332	266.939
669.81	3.74617	99.2188	266.939
669.646	3.83284	139.539	260.903
669.482	3.76543	128.984	265.574
669.317	4.03508	109.992	247.827
669.153	3.92914	86.1641	254.508
668.989	4.13138	142.578	242.05

668.825	4.16027	112.043	240.369
668.661	3.96766	132.828	252.037
668.497	4.10249	120.543	243.755
668.333	3.97729	95.6563	251.427
668.169	4.24694	101.477	235.464
668.005	4.0736	115.328	245.483
667.841	4.28546	113.141	233.347
667.677	4.51658	120.648	221.406
667.513	4.50695	122.77	221.879
667.349	4.7766	96.3516	209.354
667.185	4.72845	108.121	211.486
667.021	4.69956	94.582	212.786
666.857	4.76697	104.223	209.777
666.693	4.73808	127.277	211.056
666.529	4.85364	103.254	206.031
666.365	4.80549	133.156	208.095
666.201	4.93068	137.844	202.812
666.037	4.72845	123.84	211.486
665.873	4.73808	113.375	211.056
665.709	4.94994	97.5273	202.023
665.545	4.99809	134.125	200.076
665.381	4.85364	85.3867	206.031
665.216	4.82475	137.516	207.265
665.052	4.93068	125.992	202.812
664.888	4.90179	123.695	204.007
664.724	4.70919	115.637	212.351
664.56	4.67067	127.898	214.102
664.396	4.60325	130.258	217.238
664.232	4.67067	134.789	214.102
664.068	4.72845	133.375	211.486
663.904	4.7766	129.203	209.354
663.74	4.60325	150.414	217.238
663.576	4.54547	113.938	219.999
663.412	4.28546	115.934	233.347
663.248	3.97729	114.102	251.427
663.084	3.96766	105.242	252.037
662.92	3.90025	98.168	256.394
662.756	3.73654	120.922	267.627
662.592	3.83284	123.738	260.903
662.428	3.71728	103.852	269.014
662.264	3.74617	110.625	266.939
662.1	3.25503	111.988	307.216
661.936	2.67722	125.797	373.521
661.772	2.74464	118.949	364.347
661.608	3.13947	127.652	318.525
661.444	3.30318	138.086	302.738
661.279	3.90025	125.25	256.394
661.115	4.28546	114.027	233.347
660.951	4.25657	119.645	234.931
660.787	3.81358	123.641	262.221
660.623	3.81358	135.492	262.221
660.459	3.62098	104.898	276.168
660.295	3.90025	119.648	256.394
660.131	4.24694	111.09	235.464
659.967	4.39139	119.371	227.718
659.803	4.22768	111.391	236.536
659.639	3.90988	117.891	255.762
659.475	3.67876	112.246	271.831
659.311	3.83284	133.867	260.903
659.147	3.86173	118.207	258.951
658.983	4.21805	98	237.076
658.819	4.27583	95.9297	233.873
658.655	4.09286	91.8281	244.328
658.491	3.99656	118.832	250.215
658.327	3.58246	100.543	279.138
658.163	3.51505	130.938	284.491
657.999	4.00619	103.758	249.614
657.835	4.28546	131.555	233.347

657.671	4.10249	114.121	243.755
657.507	3.96766	114.023	252.037
657.343	3.96766	103.918	252.037
657.178	3.86173	96.1055	258.951
657.014	4.38176	88.1953	228.219
656.85	4.58399	91.3438	218.15
656.686	4.82475	85.9336	207.265
656.522	4.93068	89.8359	202.812
656.358	5.04624	110.797	198.167
656.194	4.94994	100.152	202.023
656.03	4.75734	102.645	210.202
655.866	4.6803	115.438	213.662
655.702	5.05587	132.547	197.79
655.538	5.14254	87.6523	194.456
655.374	5.09439	108.746	196.294
655.21	5.01735	114.867	199.308
655.046	4.95957	112.273	201.63
654.882	4.86327	92.8945	205.623
654.718	4.98846	95.4648	200.463
654.554	4.92105	91.7773	203.209
654.39	4.94994	96.0898	202.023
654.226	5.15217	107.535	194.093
654.062	5.46997	113.406	182.816
653.898	5.5759	112.848	179.343
653.734	5.62405	126.93	177.808
653.57	5.72035	102.316	174.814
653.406	5.52775	91.5625	180.905
653.242	5.55664	94.4531	179.965
653.077	5.55664	113.172	179.965
652.913	5.56627	112.445	179.654
652.749	5.59516	109.332	178.726
652.585	5.6722	96.8711	176.298
652.421	5.5759	102.695	179.343
652.257	5.55664	89.457	179.965
652.093	5.53738	112.816	180.591
651.929	5.53738	110.754	180.591
651.765	5.59516	103.941	178.726
651.601	5.6722	125.68	176.298
651.437	5.6722	135.883	176.298
651.273	5.62405	93.9492	177.808
651.109	5.66257	106.793	176.598
650.945	5.66257	113.789	176.598
650.781	5.53738	114.754	180.591
650.617	5.52775	142.453	180.905
650.453	5.63368	114.789	177.504
650.289	5.49886	122.5	181.856
650.125	5.70109	109.602	175.405
649.961	5.70109	118.789	175.405
649.797	5.65294	118.867	176.899
649.633	5.52775	119.707	180.905
649.469	5.65294	85.3203	176.899
649.305	5.3833	127.977	185.76
649.141	5.3833	111.57	185.76
648.976	5.34478	107.406	187.099
648.812	5.09439	133.125	196.294
648.648	4.86327	118.84	205.623
648.484	5.04624	108.969	198.167
648.32	5.40256	110.844	185.098
648.156	5.287	110.57	189.143
647.992	5.44108	99.0625	183.787
647.828	5.60479	95.9844	178.419
647.664	5.94185	114.273	168.298
647.5	5.81665	98.0117	171.92
647.336	5.95148	123.434	168.026
647.172	5.89369	107.457	169.673
647.008	5.52775	112.551	180.905
646.844	5.30626	103.828	188.457
646.68	4.85364	106.383	206.031

646.516	4.42028	90.0977	226.23
646.352	4.09286	116.91	244.328
646.188	4.27583	102.426	233.873
646.024	4.16027	83.0156	240.369
645.86	4.22768	108.313	236.536
645.696	4.34324	107.02	230.243
645.532	4.76697	116.852	209.777
645.368	5.23884	111.414	190.882
645.204	5.30626	127.027	188.457
645.04	5.49886	121.238	181.856
644.875	5.70109	77.5	175.405
644.711	5.82628	129.664	171.636
644.547	5.92259	110.313	168.845
644.383	5.7685	88.2813	173.355
644.219	5.74924	114.699	173.936
644.055	5.88406	124.242	169.951
643.891	5.75887	113.477	173.645
643.727	5.81665	106.457	171.92
643.563	5.89369	107.527	169.673
643.399	6.00926	86.9063	166.41
643.235	6.11519	104.379	163.527
643.071	6.03815	93.9102	165.614
642.907	5.98037	94.3477	167.214
642.743	6.03815	122.059	165.614
642.579	5.98037	111.754	167.214
642.415	6.03815	104.863	165.614
642.251	5.81665	118.313	171.92
642.087	5.79739	99.5977	172.491
641.923	5.81665	102.863	171.92
641.759	5.84554	103.742	171.07
641.595	5.89369	126.645	169.673
641.431	5.79739	110.391	172.491
641.267	5.6722	91.9844	176.298
641.103	5.72998	108.391	174.521
640.938	5.6722	122.285	176.298
640.774	5.60479	101.473	178.419
640.61	5.5759	116.977	179.343
640.446	5.36404	129.383	186.427
640.282	5.30626	118.008	188.457
640.118	5.43145	91.3555	184.113
639.954	5.55664	109.871	179.965
639.79	5.50849	94.1016	181.538
639.626	5.56627	108.941	179.654
639.462	5.52775	104.68	180.905
639.298	5.59516	113.637	178.726
639.134	5.56627	108.352	179.654
638.97	5.60479	105.406	178.419
638.806	5.6722	70.1719	176.298
638.642	5.62405	113.711	177.808
638.478	5.6722	100.113	176.298
638.314	5.62405	98.6289	177.808
638.15	5.81665	110.691	171.92
637.986	5.7685	122.395	173.355
637.822	5.5759	98.4922	179.343
637.658	5.75887	96.9727	173.645
637.494	5.6722	136.383	176.298
637.33	5.62405	91.4531	177.808
637.166	5.74924	101.594	173.936
637.002	5.72035	120.555	174.814
636.837	5.95148	107.301	168.026
636.673	5.96111	113.957	167.754
636.509	5.81665	105.652	171.92
636.345	5.66257	115.027	176.598
636.181	5.70109	87.8438	175.405
636.017	5.69146	116.27	175.702
635.853	5.85517	98.168	170.789
635.689	5.79739	134.195	172.491
635.525	5.94185	92.2344	168.298

635.361	5.95148	99.2266	168.026
635.197	6.14408	103.781	162.758
635.033	6.17297	109.988	161.997
634.869	6.05741	120.473	165.087
634.705	6.07667	116.703	164.564
634.541	6.30779	85.332	158.534
634.377	6.21149	129.891	160.992
634.213	6.33668	129.039	157.811
634.049	6.3752	85.9102	156.858
633.885	6.42335	101.617	155.682
633.721	6.51965	126.172	153.382
633.557	6.39446	89.0234	156.385
633.393	6.72189	121.488	148.768
633.229	6.71226	90.1563	148.981
633.065	6.693	98.125	149.41
632.901	6.62559	108.383	150.93
632.736	6.80856	92.8008	146.874
632.572	6.81819	103.789	146.667
632.408	6.74115	80.8867	148.343
632.244	6.75078	108.93	148.131
632.08	6.74115	99.6719	148.343
631.916	6.71226	107.781	148.981
631.752	6.76041	115.754	147.92
631.588	6.7893	90.9727	147.291
631.424	6.68337	118.949	149.625
631.26	6.693	82.8438	149.41
631.096	6.77967	79.9688	147.5
630.932	6.58707	120.984	151.813
630.768	6.74115	109.91	148.343
630.604	6.5967	105.539	151.591
630.44	6.58707	104.266	151.813
630.276	6.72189	99.0508	148.768
630.112	6.74115	108.227	148.343
629.948	6.7893	80.8242	147.291
629.784	6.77967	120.449	147.5
629.62	6.52928	116.457	153.156
629.456	6.64485	110.207	150.493
629.292	6.5967	108.133	151.591
629.128	6.4715	111.305	154.524
628.964	6.33668	117.555	157.811
628.8	6.33668	111.934	157.811
628.635	6.52928	107.652	153.156
628.471	6.26927	121.488	159.508
628.307	6.24038	109.668	160.247
628.143	6.20186	128.633	161.242
627.979	6.07667	106.965	164.564
627.815	6.25964	124.258	159.754
627.651	6.1826	122.656	161.744
627.487	6.01889	111.805	166.144
627.323	5.94185	97.0781	168.298
627.159	6.07667	102.031	164.564
626.995	6.17297	100.297	161.997
626.831	6.01889	98.1875	166.144
626.667	6.07667	111.078	164.564
626.503	5.94185	109.629	168.298
626.339	5.88406	94.75	169.951
626.175	6.00926	99.5898	166.41
626.011	5.91296	105.586	169.12
625.847	5.88406	99.8047	169.951
625.683	5.91296	105.074	169.12
625.519	5.8648	89.6172	170.509
625.355	5.84554	104.109	171.07
625.191	5.89369	103.418	169.673
625.027	5.91296	88.1172	169.12
624.863	5.85517	89.6602	170.789
624.698	5.69146	135.883	175.702
624.534	5.69146	86.1367	175.702
624.37	5.84554	109.898	171.07

624.206	5.79739	141.656	172.491
624.042	5.95148	104.898	168.026
623.878	5.72998	110.578	174.521
623.714	5.69146	101.461	175.702
623.55	5.84554	120.543	171.07
623.386	5.92259	89.1641	168.845
623.222	5.53738	105.367	180.591
623.058	5.5759	94.5156	179.343
622.894	5.52775	96.8281	180.905
622.73	5.6722	105.898	176.298
622.566	5.46997	114.469	182.816
622.402	5.74924	101.258	173.936
622.238	5.50849	118.617	181.538
622.074	5.33515	115.273	187.436
621.91	5.4796	101.621	182.495
621.746	5.43145	112.859	184.113
621.582	5.46997	97.4492	182.816
621.418	5.40256	102.504	185.098
621.254	5.46997	99.1914	182.816
621.09	5.5759	100.414	179.343
620.926	5.63368	104.797	177.504
620.762	5.66257	98.4258	176.598
620.597	5.81665	121.719	171.92
620.433	5.81665	109.273	171.92
620.269	5.65294	121.27	176.899
620.105	5.44108	77.3125	183.787
619.941	5.53738	83.7734	180.591
619.777	5.55664	105.344	179.965
619.613	5.41219	123.504	184.768
619.449	5.36404	122.914	186.427
619.285	5.30626	103.281	188.457
619.121	5.43145	115.133	184.113
618.957	5.59516	102.836	178.726
618.793	5.72035	78.8438	174.814
618.629	5.59516	101.695	178.726
618.465	5.6722	93.7539	176.298
618.301	5.72998	108.184	174.521
618.137	5.62405	102.133	177.808
617.973	5.62405	95.2461	177.808
617.809	5.40256	109.129	185.098
617.645	5.4796	126.602	182.495
617.481	5.46997	101.785	182.816
617.317	5.41219	103.457	184.768
617.153	5.56627	108.82	179.654
616.989	5.65294	95.3125	176.899
616.825	5.72998	125.164	174.521
616.661	5.53738	95.5156	180.591
616.496	5.53738	95.6641	180.591
616.332	5.287	95.6172	189.143
616.168	5.44108	108.125	183.787
616.004	5.44108	128.625	183.787
615.84	5.43145	105.391	184.113
615.676	5.30626	100.996	188.457
615.512	5.26774	101.141	189.835
615.348	5.21958	85.9492	191.586
615.184	5.17143	100.27	193.37
615.02	5.19069	94.207	192.652
614.856	5.11365	105.719	195.555
614.692	5.14254	92.75	194.456
614.528	5.0655	131.719	197.414
614.364	4.98846	109.586	200.463
614.2	5.17143	112.504	193.37
614.036	4.99809	106.676	200.076
613.872	5.11365	106.926	195.555
613.708	5.14254	123.336	194.456
613.544	5.37367	103.059	186.093
613.38	5.287	127.813	189.143
613.216	5.24847	96.0078	190.532

613.052	5.36404	93.0273	186.427
612.888	5.53738	130.305	180.591
612.724	5.26774	115.75	189.835
612.56	5.44108	93.9063	183.787
612.395	5.30626	97.4492	188.457
612.231	5.30626	91.1523	188.457
612.067	5.3833	91.7422	185.76
611.903	5.31589	109.391	188.115
611.739	5.33515	83.3711	187.436
611.575	5.46034	112.262	183.139
611.411	5.55664	115.055	179.965
611.247	5.60479	135.531	178.419
611.083	5.41219	108.551	184.768
610.919	5.37367	107.406	186.093
610.755	4.93068	107.703	202.812
610.591	4.98846	94.3203	200.463
610.427	4.76697	118.883	209.777
610.263	4.92105	120.605	203.209
610.099	5.11365	106.004	195.555
609.935	5.27737	108.184	189.488
609.771	5.36404	89.7461	186.427
609.607	5.09439	97.7656	196.294
609.443	5.36404	114.141	186.427
609.279	5.27737	116.469	189.488
609.115	5.15217	76.6289	194.093
608.951	5.19069	73.8711	192.652
608.787	5.24847	97.2813	190.532
608.623	5.31589	134.313	188.115
608.458	5.43145	103.836	184.113
608.294	5.20995	112.375	191.94
608.13	5.18106	118.297	193.011
607.966	5.0655	99.957	197.414
607.802	5.05587	119.129	197.79
607.638	4.94994	113.105	202.023
607.474	4.80549	133.195	208.095
607.31	4.90179	124.426	204.007
607.146	4.93068	95.3984	202.812
606.982	4.94994	97.125	202.023
606.818	4.9692	107.473	201.24
606.654	5.01735	126.359	199.308
606.49	5.0655	110.895	197.414
606.326	4.98846	101.945	200.463
606.162	4.94994	100.719	202.023
605.998	5.11365	111.316	195.555
605.834	5.02698	92.7656	198.927
605.67	4.98846	112.75	200.463
605.506	5.11365	119.512	195.555
605.342	5.01735	112.031	199.308
605.178	5.11365	92.0898	195.555
605.014	5.04624	95.1523	198.167
604.85	4.98846	84.5508	200.463
604.686	4.99809	106.176	200.076
604.522	4.94994	96.207	202.023
604.357	5.04624	90.7227	198.167
604.193	5.17143	101.992	193.37
604.029	5.05587	135.516	197.79
603.865	5.04624	104.711	198.167
603.701	5.01735	98.4883	199.308
603.537	4.98846	92.8086	200.463
603.373	5.08476	100.797	196.666
603.209	4.99809	129.734	200.076
603.045	5.15217	104.828	194.093
602.881	5.04624	113.121	198.167
602.717	5.09439	110.586	196.294
602.553	4.95957	116.855	201.63
602.389	5.09439	113.766	196.294
602.225	4.90179	113.426	204.007
602.061	4.94994	123.75	202.023

601.897	5.02698	93.4922	198.927
601.733	5.08476	107.949	196.666
601.569	4.83438	111.52	206.852
601.405	4.7766	130.273	209.354
601.241	4.83438	121.68	206.852
601.077	4.7766	112.27	209.354
600.913	4.83438	93.7031	206.852
600.749	4.86327	97.7109	205.623
600.585	4.79586	123.516	208.513
600.421	5.02698	138.336	198.927
600.256	4.89216	121.707	204.409
600.092	5.02698	102.75	198.927
599.928	5.04624	108.254	198.167
599.764	4.93068	116.223	202.812
599.6	4.93068	97.0469	202.812
599.436	4.9692	81.1172	201.24
599.272	4.9692	106.809	201.24
599.108	4.95957	98.4141	201.63
598.944	4.72845	114.328	211.486
598.78	4.95957	110.039	201.63
598.616	4.99809	102.27	200.076
598.452	5.11365	98.9414	195.555
598.288	4.95957	113.793	201.63
598.124	5.05587	89.6875	197.79
597.96	5.0655	86.707	197.414
597.796	4.90179	113.055	204.007
597.632	4.89216	107.281	204.409
597.468	4.90179	89.2695	204.007
597.304	4.85364	93.2734	206.031
597.14	4.95957	81.4336	201.63
596.976	4.94994	109.254	202.023
596.812	4.95957	105.832	201.63
596.648	4.99809	122.816	200.076
596.484	4.99809	120.438	200.076
596.32	5.01735	110.492	199.308
596.155	5.02698	104.047	198.927
595.991	4.98846	132.703	200.463
595.827	5.12328	115.043	195.187
595.663	5.12328	82.1055	195.187
595.499	5.26774	144.109	189.835
595.335	5.15217	101.113	194.093
595.171	5.26774	103.926	189.835
595.007	5.287	108.469	189.143
594.843	5.31589	118.023	188.115
594.679	5.08476	105.898	196.666
594.515	5.01735	121.93	199.308
594.351	5.24847	125.906	190.532
594.187	5.18106	88.4844	193.011
594.023	5.01735	108.512	199.308
593.859	5.23884	92.9844	190.882
593.695	5.14254	96.5469	194.456
593.531	5.21958	112.375	191.586
593.367	5.08476	106.684	196.666
593.203	5.20995	127.477	191.94
593.039	5.31589	115.961	188.115
592.875	5.24847	111.961	190.532
592.711	5.27737	103.879	189.488
592.547	5.26774	96.5977	189.835
592.383	5.17143	137.57	193.37
592.218	5.20995	129.469	191.94
592.054	5.15217	104.656	194.093
591.89	5.14254	119.953	194.456
591.726	5.04624	89.9453	198.167
591.562	5.11365	117.984	195.555
591.398	5.18106	105.523	193.011
591.234	5.0655	101.492	197.414
591.07	5.12328	99.1523	195.187
590.906	5.11365	88.5977	195.555

590.742	5.18106	96.75	193.011
590.578	5.08476	101.043	196.666
590.414	5.0655	110.73	197.414
590.25	4.95957	97.293	201.63
590.086	5.18106	88.7695	193.011
589.922	5.08476	92.5859	196.666
589.758	5.11365	122.684	195.555
589.594	5.23884	109.902	190.882
589.43	5.19069	89.5742	192.652
589.266	5.09439	124.938	196.294
589.102	5.01735	120.113	199.308
588.938	5.09439	76.8281	196.294
588.774	5.21958	92.5586	191.586
588.61	5.08476	110.973	196.666
588.446	5.08476	111.328	196.666
588.282	5.24847	106.676	190.532
588.117	5.287	129.023	189.143
587.953	5.19069	130.469	192.652
587.789	5.33515	102.414	187.436
587.625	5.21958	142.57	191.586
587.461	5.17143	109.352	193.37
587.297	5.11365	103.887	195.555
587.133	5.287	108.664	189.143
586.969	5.19069	119.711	192.652
586.805	5.18106	98.3633	193.011
586.641	5.287	84.3594	189.143
586.477	5.26774	116.82	189.835
586.313	5.31589	105.77	188.115
586.149	5.23884	104.148	190.882
585.985	5.09439	91.0273	196.294
585.821	5.18106	137.477	193.011
585.657	5.24847	112.508	190.532
585.493	5.23884	94.5273	190.882
585.329	5.43145	76.4648	184.113
585.165	5.26774	136.633	189.835
585.001	5.287	81.668	189.143
584.837	5.19069	98.6211	192.652
584.673	5.21958	95.0859	191.586
584.509	5.23884	100.563	190.882
584.345	5.27737	104.238	189.488
584.181	5.287	115.027	189.143
584.016	5.23884	83.8945	190.882
583.852	5.27737	95.0273	189.488
583.688	5.43145	114.313	184.113
583.524	5.287	120.125	189.143
583.36	5.43145	116.391	184.113
583.196	5.4796	98.2344	182.495
583.032	5.34478	118.625	187.099
582.868	5.36404	119.945	186.427
582.704	5.287	98.668	189.143
582.54	5.18106	112.156	193.011
582.376	5.20995	97.6094	191.94
582.212	5.37367	105.066	186.093
582.048	5.26774	103.211	189.835
581.884	5.41219	122.371	184.768
581.72	5.23884	100.602	190.882
581.556	5.24847	106.223	190.532
581.392	5.18106	104.094	193.011
581.228	5.17143	103.723	193.37
581.064	5.287	98.957	189.143
580.9	5.30626	110.402	188.457
580.736	5.26774	114.898	189.835
580.572	5.287	83.1914	189.143
580.408	5.26774	127.305	189.835
580.244	5.30626	98.4727	188.457
580.08	5.27737	108.277	189.488
579.915	5.26774	94.2031	189.835
579.751	5.287	117.309	189.143

579.587	5.26774	88.4375	189.835
579.423	5.18106	101.238	193.011
579.259	5.20995	119.684	191.94
579.095	5.21958	98.8672	191.586
578.931	5.27737	120.961	189.488
578.767	5.27737	99.7852	189.488
578.603	5.20995	86.9609	191.94
578.439	5.30626	102.25	188.457
578.275	5.23884	107.512	190.882
578.111	5.12328	97	195.187
577.947	5.34478	120.879	187.099
577.783	5.20995	116.449	191.94
577.619	5.14254	125.496	194.456
577.455	5.19069	91.4688	192.652
577.291	5.30626	121.902	188.457
577.127	5.41219	126.086	184.768
576.963	5.23884	104.988	190.882
576.799	5.24847	105.754	190.532
576.635	5.30626	101.609	188.457
576.471	5.18106	114.445	193.011
576.307	5.18106	91.3164	193.011
576.143	5.23884	104.172	190.882
575.978	5.27737	124.063	189.488
575.814	5.27737	85.7969	189.488
575.65	5.18106	121.852	193.011
575.486	5.24847	118.137	190.532
575.322	5.60479	106.32	178.419
575.158	5.20995	120.309	191.94
574.994	5.53738	92.9609	180.591
574.83	5.8648	105.367	170.509
574.666	5.41219	105.656	184.768
574.502	5.15217	102.293	194.093
574.338	4.98846	94.3281	200.463
574.174	5.09439	84.8008	196.294
574.01	5.18106	107.273	193.011
573.846	5.17143	117.844	193.37
573.682	5.34478	99.8125	187.099
573.518	5.46034	68.1211	183.139
573.354	5.81665	100.84	171.92
573.19	5.40256	110.168	185.098
573.026	5.21958	124.203	191.586
572.862	5.20995	98.7148	191.94
572.698	5.31589	116.293	188.115
572.534	5.24847	101.543	190.532
572.37	5.3833	118.969	185.76
572.206	5.46997	107.266	182.816
572.042	5.44108	86.4805	183.787
571.877	5.46034	104.813	183.139
571.713	5.26774	109.039	189.835
571.549	5.14254	97.8633	194.456
571.385	5.12328	99.7383	195.187
571.221	5.27737	134.109	189.488
571.057	5.15217	93.543	194.093
570.893	5.12328	110.055	195.187
570.729	5.23884	108.406	190.882
570.565	5.14254	120.188	194.456
570.401	5.14254	113.957	194.456
570.237	4.98846	89.4883	200.463
570.073	5.17143	102.098	193.37
569.909	5.23884	90.7578	190.882
569.745	5.26774	110.117	189.835
569.581	5.14254	113.492	194.456
569.417	5.11365	97.9688	195.555
569.253	5.19069	109.238	192.652
569.089	5.23884	110.09	190.882
568.925	5.08476	99.9453	196.666
568.761	5.11365	110.051	195.555
568.597	5.26774	99.1953	189.835

568.433	5.19069	115.934	192.652
568.269	5.14254	100.59	194.456
568.105	5.17143	140.922	193.37
567.941	5.287	110.664	189.143
567.776	5.26774	97.9023	189.835
567.612	5.30626	108.406	188.457
567.448	5.33515	107.367	187.436
567.284	5.41219	111.406	184.768
567.12	5.52775	107.043	180.905
566.956	5.30626	135.727	188.457
566.792	5.24847	123.258	190.532
566.628	5.287	110.902	189.143
566.464	5.19069	112.184	192.652
566.3	5.30626	85.5781	188.457
566.136	5.23884	65.8906	190.882
565.972	5.17143	92.6523	193.37
565.808	5.11365	106.301	195.555
565.644	5.20995	85.6445	191.94
565.48	5.36404	117.82	186.427
565.316	5.24847	112.789	190.532
565.152	5.21958	94.168	191.586
564.988	5.27737	100.281	189.488
564.824	5.43145	103.379	184.113
564.66	5.12328	92.7188	195.187
564.496	5.24847	110.742	190.532
564.332	5.14254	111.277	194.456
564.168	5.19069	112.285	192.652
564.004	5.20995	84.6523	191.94
563.84	5.21958	96.4258	191.586
563.675	5.17143	88.3633	193.37
563.511	5.08476	94.5313	196.666
563.347	5.20995	92.5742	191.94
563.183	5.23884	121.527	190.882
563.019	5.19069	110.207	192.652
562.855	5.18106	93.9492	193.011
562.691	5.26774	120.051	189.835
562.527	5.30626	121.332	188.457
562.363	5.21958	112.648	191.586
562.199	5.17143	99.7852	193.37
562.035	5.14254	87.9492	194.456
561.871	5.27737	96.6055	189.488
561.707	5.19069	111.102	192.652
561.543	5.17143	106.004	193.37
561.379	5.19069	142.227	192.652
561.215	5.27737	94.7305	189.488
561.051	5.36404	87.8047	186.427
560.887	5.33515	103.359	187.436
560.723	5.20995	103.523	191.94
560.559	5.09439	108.793	196.294
560.395	5.24847	95.3789	190.532
560.231	5.26774	102.219	189.835
560.067	5.24847	111.324	190.532
559.903	5.14254	113.848	194.456
559.738	5.23884	124.254	190.882
559.574	5.14254	112.809	194.456
559.41	4.98846	114.402	200.463
559.246	5.04624	99.1523	198.167
559.082	5.18106	106.121	193.011
558.918	5.12328	102.813	195.187
558.754	5.09439	117.215	196.294
558.59	5.15217	118.773	194.093
558.426	5.17143	131.188	193.37
558.262	5.12328	104.254	195.187
558.098	5.0655	103.023	197.414
557.934	5.05587	122.895	197.79
557.77	4.98846	110.176	200.463
557.606	5.02698	120.098	198.927
557.442	5.04624	122.699	198.167

557.278	5.04624	99.0508	198.167
557.114	4.94994	104.32	202.023
556.95	5.14254	120.18	194.456
556.786	5.33515	74.2617	187.436
556.622	5.14254	101.813	194.456
556.458	5.14254	121.98	194.456
556.294	5.14254	108.727	194.456
556.13	4.98846	119.57	200.463
555.966	4.95957	104.867	201.63
555.802	4.95957	105.566	201.63
555.637	5.01735	119.078	199.308
555.473	4.9692	88.2148	201.24
555.309	4.9692	124.957	201.24
555.145	5.02698	95.8945	198.927
554.981	4.93068	113.438	202.812
554.817	5.04624	90.2266	198.167
554.653	5.15217	110.691	194.093
554.489	5.12328	104.84	195.187
554.325	5.02698	127.016	198.927
554.161	5.01735	103.367	199.308
553.997	5.08476	80.3711	196.666
553.833	5.01735	116.855	199.308
553.669	5.05587	91.043	197.79
553.505	5.34478	127.953	187.099
553.341	5.24847	101.082	190.532
553.177	5.15217	123.293	194.093
553.013	4.9692	116.531	201.24
552.849	4.73808	133.766	211.056
552.685	4.43954	124.059	225.248
552.521	4.32398	114.598	231.268
552.357	4.63215	102.484	215.883
552.193	5.15217	102.746	194.093
552.029	5.69146	108.805	175.702
551.865	5.85517	132.547	170.789
551.701	5.17143	122.996	193.37
551.536	3.23577	96.1406	309.045
551.372	0.760825	109.039	1314.36
551.208	-0.568136	100.215	-1760.14
551.044	-1.59856	118.664	-625.562
550.88	-2.5038	112.492	-399.394
550.716	-2.31119	101.711	-432.677
550.552	-1.31929	117.773	-757.985
550.388	-0.414053	93.6328	-2415.15
550.224	0.0867143	112.07	11532.1
550.06	0.712674	105.848	1403.17
549.896	2.04163	98.9961	489.804
549.732	3.16836	88.4492	315.62
549.568	2.65796	105.734	376.228
549.404	1.50235	92.4648	665.625
549.24	-0.346642	92.4141	-2884.82
549.076	-3.38977	69.0078	-295.005
548.912	-5.5084	63.5605	-181.541
548.748	-5.38321	72.957	-185.763
548.584	-3.99647	54.873	-250.221
548.42	-2.13785	71.4727	-467.76
548.256	0.44303	55.2676	2257.18
548.092	2.77353	93.7891	360.552
547.928	4.13138	68.0742	242.05
547.764	4.85364	64.5195	206.031
547.6	4.80549	56.8652	208.095
547.435	4.66104	78.1836	214.545
547.271	4.69956	51.9531	212.786
547.107	4.53584	60.1172	220.466
546.943	3.99656	74.7266	250.215
546.779	3.11058	57.3652	321.483
546.615	2.07053	52.6211	482.969
546.451	1.28085	55.4355	780.73
546.287	1.30011	53.5586	769.164

546.123	1.82977	60.7109	546.516
545.959	2.85057	58.4355	350.807
545.795	4.09286	72.3125	244.328
545.631	5.05587	67.2656	197.79
545.467	5.287	66.3359	189.143
545.303	5.11365	72.7305	195.555
545.139	5.50849	66.5391	181.538
544.975	5.85517	54.9805	170.789
544.811	5.8648	49.127	170.509
544.647	6.52928	51.6719	153.156
544.483	7.19377	64.5977	139.009
544.319	8.03159	56.8301	124.508
544.155	8.54199	57.209	117.069
543.991	8.82126	51.8398	113.362
543.827	8.21456	56.7773	121.735
543.663	7.55008	56.7715	132.449
543.499	7.10709	35.9004	140.704
543.334	6.81819	67.1367	146.667
543.17	6.56781	68.0625	152.258
543.006	6.20186	61.3398	161.242
542.842	5.7685	63.1582	173.355
542.678	5.85517	53.8457	170.789
542.514	5.8648	70.4609	170.509
542.35	5.94185	66.707	168.298
542.186	5.81665	79.3477	171.92
542.022	5.62405	55.6328	177.808
541.858	5.46034	34.8555	183.139
541.694	5.27737	55.3887	189.488
541.53	5.24847	58.666	190.532
541.366	5.12328	61.7383	195.187
541.202	5.04624	38.1699	198.167
541.038	5.15217	56.6348	194.093
540.874	5.12328	76.4414	195.187
540.71	5.19069	60.8418	192.652
540.546	5.37367	65.1797	186.093
540.382	5.5759	61.5957	179.343
540.218	5.6722	61.8262	176.298
540.054	5.65294	73.332	176.899
539.89	5.55664	63.9648	179.965
539.726	5.5759	45.2773	179.343
539.562	5.50849	59.7383	181.538
539.397	5.15217	63.541	194.093
539.233	5.20995	68.5664	191.94
539.069	5.43145	48.7461	184.113
538.905	5.56627	43.8242	179.654
538.741	5.46997	71.5625	182.816
538.577	5.31589	52.3984	188.115
538.413	5.23884	65.6758	190.882
538.249	5.36404	58.7715	186.427
538.085	5.14254	64.8516	194.456
537.921	5.15217	52.0547	194.093
537.757	5.287	58.9727	189.143
537.593	5.53738	51.2578	180.591
537.429	5.33515	71.5039	187.436
537.265	5.34478	61.5879	187.099
537.101	5.59516	58.4199	178.726
536.937	5.46997	45.0938	182.816
536.773	5.36404	53.6055	186.427
536.609	4.99809	74.7344	200.076
536.445	4.56473	70.6328	219.071
536.281	4.6803	75.2109	213.662
536.117	4.80549	58.6934	208.095
535.953	4.83438	71.4258	206.852
535.789	4.92105	50.1992	203.209
535.625	5.23884	53.5332	190.882
535.461	5.30626	45.4688	188.457
535.296	5.17143	75.1367	193.37
535.132	5.287	71.5391	189.143

534.968	5.37367	55.1758	186.093
534.804	5.41219	45.7539	184.768
534.64	5.46034	45.5879	183.139
534.476	5.3833	55.5723	185.76
534.312	5.33515	48.9844	187.436
534.148	5.36404	55.4121	186.427
533.984	5.36404	55.1973	186.427
533.82	5.40256	50.7109	185.098
533.656	5.36404	83.9102	186.427
533.492	5.3833	72.5742	185.76
533.328	5.14254	71.2852	194.456
533.164	5.01735	54.8457	199.308
533	4.8729	53.625	205.217
532.836	4.73808	63.7305	211.056
532.672	4.93068	56.5898	202.812
532.508	5.56627	47.9941	179.654
532.344	5.52775	54.4043	180.905
532.18	5.21958	74.0469	191.586
532.016	4.73808	57.4883	211.056
531.852	4.56473	37.3457	219.071
531.688	4.64178	48.4902	215.435
531.524	4.90179	50.2109	204.007
531.36	5.0655	63.5352	197.414
531.195	5.01735	55.6973	199.308
531.031	4.57436	55.3398	218.61
530.867	4.32398	56.4434	231.268
530.703	4.48769	54.6895	222.832
530.539	4.86327	58.4492	205.623
530.375	5.08476	60.4141	196.666
530.211	4.95957	77.0156	201.63
530.047	4.54547	68.0234	219.999
529.883	4.37213	61.373	228.721
529.719	4.67067	47.5703	214.102
529.555	5.0655	31.2852	197.414
529.391	5.09439	71.8125	196.294
529.227	5.15217	55.6719	194.093
529.063	5.63368	54.3711	177.504
528.899	5.84554	55.1191	171.07
528.735	5.53738	50.5508	180.591
528.571	5.21958	45.1309	191.586
528.407	4.95957	48.3027	201.63
528.243	4.94994	53.1973	202.023
528.079	5.21958	65.0586	191.586
527.915	5.50849	57.998	181.538
527.751	5.85517	50.7129	170.789
527.587	6.25964	61.3945	159.754
527.423	6.94338	45.0859	144.022
527.259	7.46341	56.8164	133.987
527.094	7.52119	58.8164	132.958
526.93	7.27081	63.5625	137.536
526.766	7.2034	62.9961	138.823
526.602	7.12635	53.459	140.324
526.438	7.12635	70.2383	140.324
526.274	7.2997	50.7188	136.992
526.11	7.36711	65.2031	135.738
525.946	7.1745	60.1992	139.382
525.782	7.26118	58.3809	137.719
525.618	7.55008	55.4961	132.449
525.454	7.45378	60.4414	134.16
525.29	7.41526	43.8574	134.857
525.126	7.55971	60.2266	132.28
524.962	7.61749	47.3496	131.277
524.798	7.4923	56.3633	133.47
524.634	7.54045	55.5117	132.618
524.47	7.36711	59.0527	135.738
524.306	7.14561	51.6348	139.946
524.142	7.06857	46.3555	141.471
523.978	6.72189	64.9922	148.768

523.814	6.68337	56.9277	149.625
523.65	6.55818	59.4941	152.481
523.486	6.4715	53.9355	154.524
523.322	6.42335	63.5176	155.682
523.157	6.14408	78.3398	162.758
522.993	6.13445	58.793	163.014
522.829	6.15371	58.668	162.504
522.665	6.11519	77.6641	163.527
522.501	6.04778	56.7031	165.35
522.337	6.0863	60.0781	164.303
522.173	6.39446	55.4551	156.385
522.009	6.54854	53.5859	152.706
521.845	6.64485	69.5703	150.493
521.681	6.71226	68.0313	148.981
521.517	6.77967	47.5195	147.5
521.353	6.85671	49.3867	145.843
521.189	6.80856	53.9707	146.874
521.025	6.95301	77.8828	143.823
520.861	6.84708	58.6016	146.048
520.697	6.75078	79.0039	148.131
520.533	6.75078	63.0918	148.131
520.369	6.71226	46.7148	148.981
520.205	6.74115	65.1016	148.343
520.041	6.66411	56.7793	150.058
519.877	6.72189	48.4141	148.768
519.713	6.76041	55.0137	147.92
519.549	6.80856	73.207	146.874
519.385	6.51965	57.9688	153.382
519.221	6.46187	67.207	154.754
519.056	6.42335	45.6973	155.682
518.892	6.3752	66.7109	156.858
518.728	6.46187	50.3613	154.754
518.564	6.61596	69.5898	151.15
518.4	6.52928	58.4844	153.156
518.236	6.24038	55.6484	160.247
518.072	5.99	60.5742	166.945
517.908	5.89369	63.4199	169.673
517.744	5.66257	72.9766	176.598
517.58	5.41219	50.2852	184.768
517.416	6.01889	65.4297	166.144
517.252	6.693	57.1816	149.41
517.088	6.54854	52.1445	152.706
516.924	6.43298	66.5977	155.449
516.76	6.17297	51.9766	161.997
516.596	6.39446	58.666	156.385
516.432	6.17297	103.73	161.997
516.268	6.13445	57.9844	163.014
516.104	6.11519	61.8359	163.527
515.94	6.45224	33.6367	154.985
515.776	6.50039	35.252	153.837
515.612	6.65448	61.9258	150.275
515.448	6.95301	72.9219	143.823
515.284	7.84862	54.5059	127.411
515.12	8.08937	49.5742	123.619
514.955	8.26271	54.3789	121.026
514.791	9.28351	67.5234	107.718
514.627	9.37981	82.4648	106.612
514.463	8.95608	65.9336	111.656
514.299	8.54199	55.5449	117.069
514.135	8.83089	44.1973	113.239
513.971	9.53389	52.0117	104.889
513.807	10.1791	61.5039	98.2404
513.643	10.4006	48.1094	96.1483
513.479	10.7473	56.4824	93.0467
513.315	11.1903	56.7422	89.3633
513.151	9.98651	48.4355	100.135
512.987	8.69607	72.9102	114.994
512.823	8.04122	63.332	124.359

512.659	7.82935	80.0977	127.724
512.495	7.70416	58.8613	129.8
512.331	7.74268	71.6016	129.154
512.167	7.34785	71.5898	136.094
512.003	7.14561	59.1953	139.946
511.839	7.10709	63.5723	140.704
511.675	7.26118	48.8184	137.719
511.511	7.25155	71.8906	137.902
511.347	6.76041	59.666	147.92
511.183	6.71226	72.8867	148.981
511.019	6.33668	51.8672	157.811
510.854	5.91296	66.5508	169.12
510.69	5.60479	52.6777	178.419
510.526	5.44108	73.6719	183.787
510.362	5.8648	63.5137	170.509
510.198	6.1826	60.3887	161.744
510.034	6.77967	55.7988	147.5
509.87	7.99307	63.3066	125.108
509.706	8.72496	69.7891	114.614
509.542	8.86941	57.998	112.747
509.378	9.24499	72.6445	108.167
509.214	9.14869	87.5195	109.305
509.05	10.3236	50.1621	96.8658
508.886	10.6895	52.6445	93.5497
508.722	11.1036	61.1133	90.0608
508.558	11.6525	69.7852	85.8183
508.394	11.354	65.4727	88.0748
508.23	9.47611	58.7852	105.529
508.066	8.26271	55.1387	121.026
507.902	6.93375	81.1523	144.222
507.738	5.40256	74.7539	185.098
507.574	4.82475	53.832	207.265
507.41	5.59516	58.7734	178.726
507.246	7.12635	56.6426	140.324
507.082	8.16641	79.25	122.453
506.917	8.55162	56.4766	116.937
506.753	8.16641	64.9102	122.453
506.589	8.15678	74.0977	122.597
506.425	8.48421	68.6289	117.866
506.261	7.45378	85.2031	134.16
506.097	6.75078	72.8867	148.131
505.933	7.55971	82.7813	132.28
505.769	8.83089	58.2539	113.239
505.605	9.18721	64.4453	108.847
505.441	8.54199	91.8438	117.069
505.277	8.85978	61.3164	112.87
505.113	8.57088	83.832	116.674
504.949	6.76041	78.4375	147.92
504.785	6.52928	69.4453	153.156
504.621	7.44415	84.8203	134.334
504.457	8.74422	67.5273	114.361
504.293	9.66871	78.9219	103.426
504.129	10.5932	90.7773	94.4001
503.965	12.1629	71.7813	82.2171
503.801	10.3621	52.0684	96.5057
503.637	9.33166	75.832	107.162
503.473	10.1791	71.5078	98.2404
503.309	12.6637	58.5566	78.9659
503.145	13.203	76.8359	75.7405
502.981	12.2496	68.4141	81.6354
502.816	11.431	65.4297	87.4812
502.652	11.5755	73.332	86.3895
502.488	11.6044	63.0625	86.1744
502.324	10.8532	59.1348	92.1385
502.16	11.3925	62.0371	87.777
501.996	12.4422	61.502	80.3717
501.832	12.7889	72.9063	78.1929
501.668	12.6155	85.457	79.2673

501.504	12.1822	80.6328	82.0871
501.34	11.9703	74.2227	83.54
501.176	11.6718	87.5742	85.6767
501.012	11.2577	93.8789	88.8282
500.848	11.0073	67.4414	90.8488
500.684	10.6606	92.7773	93.8032
500.52	10.2465	94.6836	97.5941
500.356	9.88058	130.195	101.209
500.192	9.17758	77.1914	108.961
500.028	8.54199	134.516	117.069
499.864	8.31086	106.254	120.324
499.7	7.84862	117.027	127.411
499.536	7.55971	142.641	132.28
499.372	7.54045	119.961	132.618
499.208	7.25155	105.953	137.902
499.044	7.12635	103.25	140.324
498.88	6.84708	103.371	146.048
498.715	6.81819	102.477	146.667
498.551	6.76041	88.1523	147.92
498.387	6.51965	104.398	153.382
498.223	6.07667	72.75	164.564
498.059	5.09439	93.9609	196.294
497.895	3.38023	80.75	295.838
497.731	1.82977	73.1328	546.516
497.567	0.953428	56.7383	1048.85
497.403	0.211906	56.6777	4719.07
497.239	-1.54078	79.7422	-649.021
497.075	-3.90017	79.7539	-256.399
496.911	-7.90631	59.6855	-126.481
496.747	-13.8385	65.4727	-72.2623
496.583	-21.9663	67.1055	-45.5242
496.419	-27.9274	64.5	-35.8071
496.255	-35.9878	51.4766	-27.7872
496.091	-46.7254	76.7148	-21.4016
495.927	-44.4816	65.7891	-22.4812
495.763	-39.9266	80.7383	-25.046
495.599	-27.2533	57.0059	-36.6928
495.435	-7.89668	55.668	-126.635
495.271	5.52775	53.9414	180.905
495.107	12.5096	63.8926	79.9386
494.943	15.2542	49.5625	65.5557
494.779	16.2557	80.1602	61.5167
494.614	15.9668	74.0664	62.6298
494.45	14.9749	76.8008	66.7783
494.286	13.723	56.3438	72.8703
494.122	12.1244	43.1563	82.4783
493.958	10.6895	59.8613	93.5497
493.794	8.98497	63.3477	111.297
493.63	7.97381	57.2188	125.411
493.466	7.86788	70.6484	127.099
493.302	7.36711	72.5977	135.738
493.138	6.26927	52.1191	159.508
492.974	5.34478	68.7266	187.099
492.81	5.11365	67.8633	195.555
492.646	5.53738	70.3906	180.591
492.482	5.7685	77.2031	173.355
492.318	5.40256	54.9277	185.098
492.154	5.11365	58.043	195.555
491.99	4.89216	65.5078	204.409
491.826	4.58399	55.7656	218.15
491.662	4.51658	72.1875	221.406
491.498	4.63215	56.668	215.883
491.334	4.60325	61.7832	217.238
491.17	4.61288	55.0098	216.784
491.006	4.73808	45.3262	211.056
490.842	4.73808	64.0234	211.056
490.678	4.92105	58.627	203.209
490.513	4.76697	72.4961	209.777

490.349	4.83438	65.4336	206.852
490.185	4.92105	77.9297	203.209
490.021	5.24847	66.3594	190.532
489.857	5.24847	58.375	190.532
489.693	5.5759	69.8398	179.343
489.529	5.34478	56.002	187.099
489.365	5.18106	71.3867	193.011
489.201	4.94994	61.375	202.023
489.037	4.47806	63.2949	223.311
488.873	4.46843	57.084	223.792
488.709	4.13138	57.3203	242.05
488.545	4.25657	62.6465	234.931
488.381	4.25657	68.9922	234.931
488.217	4.63215	54.8789	215.883
488.053	4.86327	62.5684	205.623
487.889	5.37367	73.6172	186.093
487.725	5.53738	75.2578	180.591
487.561	5.63368	73.9258	177.504
487.397	5.81665	52.0078	171.92
487.233	5.98037	72.9492	167.214
487.069	6.0863	61.543	164.303
486.905	6.13445	74.4492	163.014
486.741	6.13445	62.0684	163.014
486.577	6.13445	66.2578	163.014
486.412	6.1826	68.375	161.744
486.248	6.25964	46.7031	159.754
486.084	6.29816	48.2441	158.777
485.92	6.46187	58.1172	154.754
485.756	6.97227	70.0742	143.425
485.592	7.0782	50.084	141.279
485.428	7.06857	71.2891	141.471
485.264	6.8856	50.8926	145.231
485.1	6.49076	61.8027	154.065
484.936	6.36557	56.6387	157.095
484.772	7.04931	59.7207	141.858
484.608	8.15678	48.3613	122.597
484.444	8.06048	48.4805	124.062
484.28	7.00116	40.5098	142.833
484.116	6.17297	43.6758	161.997
483.952	5.66257	44.8066	176.598
483.788	4.86327	51.0547	205.623
483.624	3.97729	59.6367	251.427
483.46	2.94687	43.4082	339.343
483.296	3.01428	43.4258	331.754
483.132	3.23577	48.2832	309.045
482.968	4.0736	57.9551	245.483
482.804	5.01735	40.3809	199.308
482.64	6.52928	76.7266	153.156
482.476	6.5967	39.3984	151.591
482.311	6.00926	51.3164	166.41
482.147	5.4796	44.9277	182.495
481.983	5.08476	38.5313	196.666
481.819	4.8729	43.6191	205.217
481.655	4.83438	55.1387	206.852
481.491	4.72845	46.1699	211.486
481.327	4.57436	51.2969	218.61
481.163	4.44917	57.7793	224.761
480.999	4.21805	31.3643	237.076
480.835	3.86173	57.0313	258.951
480.671	3.66913	43.3359	272.544
480.507	2.98539	35.4453	334.965
480.343	2.85057	50.3555	350.807
480.179	2.48462	43.8848	402.476
480.015	2.67722	43.7012	373.521
479.851	2.42684	56.2266	412.058
479.687	2.36906	57.4004	422.108
479.523	2.26313	38.3438	441.866
479.359	2.65796	36.9375	376.228

479.195	2.71575	59.6289	368.223
479.031	2.60018	53.0684	384.588
478.867	2.31128	51.25	432.661
478.703	2.42684	50.1035	412.058
478.539	3.13947	49.2148	318.525
478.375	3.12984	53.832	319.505
478.21	2.98539	45.6387	334.965
478.046	2.79279	46.0996	358.065
477.882	3.20688	63.5488	311.829
477.718	3.29355	79.2813	303.623
477.554	3.00465	43.6426	332.817
477.39	3.32244	58.0234	300.983
477.226	3.58246	54.7266	279.138
477.062	3.39949	48.0918	294.162
476.898	3.25503	61.2715	307.216
476.734	3.55357	56.2227	281.407
476.57	3.62098	38.5156	276.168
476.406	3.47653	39.7891	287.643
476.242	3.67876	51.7754	271.831
476.078	3.57283	41.1172	279.89
475.914	3.29355	51.3652	303.623
475.75	3.12984	36.2813	319.505
475.586	3.07206	32.8477	325.514
475.422	3.00465	43.0156	332.817
475.258	2.88909	51.3066	346.13
475.094	2.94687	41.248	339.343
474.93	3.36097	47.7578	297.534
474.766	3.80395	42.6816	262.884
474.602	3.86173	51.2266	258.951
474.438	3.86173	69.9648	258.951
474.274	4.22768	49.8535	236.536
474.109	4.10249	44.9219	243.755
473.945	3.66913	48.5449	272.544
473.781	3.81358	52.4883	262.221
473.617	4.27583	34.3301	233.873
473.453	4.06397	50.0605	246.065
473.289	4.18916	48.4414	238.711
473.125	4.09286	44.2109	244.328
472.961	4.41065	52.6953	226.724
472.797	4.24694	53.0078	235.464
472.633	4.22768	54.3926	236.536
472.469	4.28546	59.0254	233.347
472.305	4.43954	61.5801	225.248
472.141	4.27583	41.3398	233.873
471.977	4.43954	33.4473	225.248
471.813	4.80549	43.8262	208.095
471.649	4.90179	40.9375	204.007
471.485	4.41065	63.0234	226.724
471.321	4.24694	46.0332	235.464
471.157	4.37213	42.582	228.721
470.993	3.88099	41.0684	257.666
470.829	4.03508	47.5273	247.827
470.665	4.48769	37.1699	222.832
470.501	5.12328	60.8027	195.187
470.337	5.12328	62.752	195.187
470.173	4.8729	38.4141	205.217
470.008	4.79586	35.0859	208.513
469.844	4.7766	53.2754	209.354
469.68	4.48769	53.3262	222.832
469.516	3.93877	40.5332	253.886
469.352	3.29355	40.8984	303.623
469.188	3.49579	54.8125	286.059
469.024	3.59209	42.9395	278.39
468.86	3.51505	47.8887	284.491
468.696	3.36097	39.4434	297.534
468.532	3.59209	56.5313	278.39
468.368	3.35134	42.3203	298.389
468.204	2.56166	39.918	390.371

468.04	2.49425	53.1211	400.922
467.876	3.16836	56.4297	315.62
467.712	3.48616	51.6074	286.849
467.548	3.26466	45.0957	306.31
467.384	3.35134	43.3984	298.389
467.22	3.12984	51.5664	319.505
467.056	2.79279	34.957	358.065
466.892	2.33054	51.5938	429.085
466.728	2.50388	59.7012	399.38
466.564	2.61944	52.5625	381.76
466.4	2.56166	46.084	390.371
466.236	2.53277	47.9102	394.824
466.071	2.71575	39.6367	368.223
465.907	2.79279	64.3359	358.065
465.743	3.04317	59.543	328.605
465.579	3.28392	58.0586	304.514
465.415	3.71728	60.1602	269.014
465.251	3.74617	60.3691	266.939
465.087	3.76543	59.1465	265.574
464.923	4.41065	46.1055	226.724
464.759	4.69956	49.7969	212.786
464.595	4.47806	41.4219	223.311
464.431	3.90988	58.4453	255.762
464.267	3.93877	57.8965	253.886
464.103	4.24694	33.9648	235.464
463.939	3.88099	30.5303	257.666
463.775	3.88099	54.123	257.666
463.611	4.24694	42.332	235.464
463.447	4.39139	41.6445	227.718
463.283	4.12175	48.2109	242.616
463.119	4.06397	61.5313	246.065
462.955	4.10249	60.1133	243.755
462.791	4.29509	45.4863	232.824
462.627	3.93877	66.2109	253.886
462.463	4.05434	59.3691	246.65
462.299	4.0736	49.4199	245.483
462.135	3.90025	52.6777	256.394
461.97	4.22768	47.959	236.536
461.806	4.25657	42.9844	234.931
461.642	4.28546	46.2871	233.347
461.478	3.96766	46.377	252.037
461.314	3.88099	50.0254	257.666
461.15	4.13138	60.3555	242.05
460.986	4.34324	46.7676	230.243
460.822	4.21805	43.5996	237.076
460.658	4.15064	47.207	240.927
460.494	4.25657	44.4609	234.931
460.33	4.46843	57.0605	223.792
460.166	4.32398	49.9199	231.268
460.002	4.22768	40.8164	236.536
459.838	4.38176	47.4023	228.219
459.674	4.53584	42.8066	220.466
459.51	4.53584	53.3008	220.466
459.346	4.63215	44.2598	215.883
459.182	4.7766	36.8125	209.354
459.018	4.63215	42.9551	215.883
458.854	4.72845	59.8809	211.486
458.69	4.79586	53.5098	208.513
458.526	4.7766	40.166	209.354
458.362	4.73808	51.3555	211.056
458.198	4.83438	39.6992	206.852
458.034	5.09439	51.2109	196.294
457.869	5.02698	46.3105	198.927
457.705	4.83438	69.6797	206.852
457.541	4.99809	48.082	200.076
457.377	4.9692	44.3691	201.24
457.213	5.08476	59.4668	196.666
457.049	5.09439	36.7793	196.294

456.885	5.40256	50.2168	185.098
456.721	5.40256	43.5332	185.098
456.557	5.43145	55.1973	184.113
456.393	5.33515	60.873	187.436
456.229	5.40256	56.9277	185.098
456.065	5.30626	55.4316	188.457
455.901	5.37367	51.6895	186.093
455.737	5.11365	54.707	195.555
455.573	5.36404	42.5957	186.427
455.409	5.46997	51.3789	182.816
455.245	5.52775	60.0117	180.905
455.081	5.4796	47.543	182.495
454.917	5.40256	50.5156	185.098
454.753	5.37367	44.3496	186.093
454.589	5.3833	51.625	185.76
454.425	5.30626	35.3398	188.457
454.261	5.41219	45.3242	184.768
454.097	5.40256	60.0098	185.098
453.933	5.50849	39.7012	181.538
453.768	5.5759	56.4824	179.343
453.604	5.63368	48.1426	177.504
453.44	5.63368	52.6387	177.504
453.276	5.89369	27.8877	169.673
453.112	5.95148	36.2285	168.026
452.948	5.72035	49.9453	174.814
452.784	5.60479	53.3008	178.419
452.62	5.69146	51.5801	175.702
452.456	5.50849	36.6602	181.538
452.292	5.50849	62.2383	181.538
452.128	5.34478	50.4199	187.099
451.964	5.60479	61.2832	178.419
451.8	5.5759	56.6563	179.343
451.636	5.41219	42.9863	184.768
451.472	5.31589	48.0391	188.115
451.308	5.26774	36.1211	189.835
451.144	5.30626	41.3164	188.457
450.98	5.60479	53.377	178.419
450.816	5.69146	44.1797	175.702
450.652	5.3833	59.043	185.76
450.488	5.11365	45.2754	195.555
450.324	5.02698	38.2949	198.927
450.16	5.09439	46.6836	196.294
449.996	5.11365	41.5781	195.555
449.831	5.21958	61.6992	191.586
449.667	5.53738	56.7988	180.591
449.503	5.44108	41.6133	183.787
449.339	5.34478	43.0313	187.099
449.175	5.27737	47.8242	189.488
449.011	5.17143	74.2148	193.37
448.847	4.67067	36.3906	214.102
448.683	4.46843	31.498	223.792
448.519	4.67067	53.0996	214.102
448.355	4.76697	71.1445	209.777
448.191	4.9692	24.876	201.24
448.027	5.04624	43.5137	198.167
447.863	4.8729	45.4375	205.217
447.699	4.80549	57.6875	208.095
447.535	4.67067	39.0898	214.102
447.371	4.50695	46.2324	221.879
447.207	4.69956	46.7656	212.786
447.043	4.93068	80.1563	202.812
446.879	5.09439	49.7969	196.294
446.715	5.30626	51.166	188.457
446.551	5.30626	40.6973	188.457
446.387	5.17143	57.584	193.37
446.223	5.30626	59.1602	188.457
446.059	5.24847	50.1973	190.532
445.895	5.17143	48.3633	193.37

445.73	5.09439	45.082	196.294
445.566	5.15217	25.0576	194.093
445.402	5.0655	43.7891	197.414
445.238	5.12328	48.6543	195.187
445.074	4.82475	44.7305	207.265
444.91	4.53584	53.8867	220.466
444.746	4.8729	36.0918	205.217
444.582	5.60479	57.5918	178.419
444.418	5.72035	62.6719	174.814
444.254	5.69146	62.3691	175.702
444.09	5.34478	49.3164	187.099
443.926	5.27737	51.2578	189.488
443.762	4.93068	58.6152	202.812
443.598	4.7766	67.0547	209.354
443.434	4.75734	32.7129	210.202
443.27	4.8729	57.584	205.217
443.106	4.94994	51.543	202.023
442.942	5.17143	43.7324	193.37
442.778	5.34478	62.2715	187.099
442.614	5.52775	56.7813	180.905
442.45	5.18106	64.8555	193.011
442.286	4.95957	68.5664	201.63
442.122	4.73808	69.7617	211.056
441.958	4.63215	74.7813	215.883
441.794	4.6803	50.1934	213.662
441.629	4.42028	56.2129	226.23
441.465	5.12328	68.3203	195.187
441.301	6.07667	50.2441	164.564
441.137	6.693	41.9727	149.41
440.973	6.43298	56.7969	155.449
440.809	5.92259	64.793	168.845
440.645	5.55664	63.5098	179.965
440.481	5.05587	88.6211	197.79
440.317	4.17953	64.2031	239.261
440.153	4.12175	58.9336	242.616
439.989	4.85364	60.3945	206.031
439.825	5.31589	59.4336	188.115
439.661	5.69146	61.6445	175.702
439.497	6.00926	48.6934	166.41
439.333	5.84554	55.25	171.07
439.169	5.31589	76.6211	188.115
439.005	4.60325	77.5938	217.238
438.841	4.63215	53.2871	215.883
438.677	5.37367	55.6035	186.093
438.513	6.00926	50.0293	166.41
438.349	6.1826	58.3301	161.744
438.185	5.84554	59.7695	171.07
438.021	5.95148	48.0332	168.026
437.857	6.10556	53.2871	163.785
437.693	6.10556	38.9941	163.785
437.528	5.55664	33.6211	179.965
437.364	5.23884	61.8262	190.882
437.2	5.37367	73.7813	186.093
437.036	6.693	60.2949	149.41
436.872	7.73305	44.7852	129.315
436.708	8.31086	56.7461	120.324
436.544	8.8983	55.1914	112.381
436.38	9.49537	63.5742	105.314
436.216	9.06201	47.1699	110.351
436.052	7.99307	63.498	125.108
435.888	7.06857	58.0469	141.471
435.724	6.42335	54.7656	155.682
435.56	6.10556	87.168	163.785
435.396	6.07667	74.9023	164.564
435.232	5.94185	62.7891	168.298
435.068	5.63368	97.5977	177.504
434.904	6.11519	96.8438	163.527
434.74	7.00116	92.3789	142.833

434.576	6.74115	63.1016	148.343
434.412	6.15371	84.1563	162.504
434.248	6.0863	101.191	164.303
434.084	5.94185	51.4063	168.298
433.92	5.94185	82.6133	168.298
433.756	6.03815	84.2422	165.614
433.591	5.72035	97.8906	174.814
433.427	5.02698	80.5508	198.927
433.263	4.17953	101.629	239.261
433.099	3.59209	72.5742	278.39
432.935	4.06397	95.8047	246.065
432.771	5.12328	73.9531	195.187
432.607	5.36404	85.125	186.427
432.443	5.52775	118.098	180.905
432.279	5.63368	88.3359	177.504
432.115	5.99	72.3477	166.945
431.951	5.84554	106.164	171.07
431.787	5.24847	112.219	190.532
431.623	3.93877	113.375	253.886
431.459	2.42684	125.863	412.058
431.295	1.72384	103.176	580.1
431.131	1.34826	116.426	741.695
430.967	1.92607	128.016	519.191
430.803	3.16836	102.691	315.62
430.639	4.51658	125.59	221.406
430.475	5.5759	159.852	179.343
430.311	6.25964	108.293	159.754
430.147	6.66411	133.18	150.058
429.983	6.62559	91.0039	150.93
429.819	6.29816	101.602	158.777
429.655	5.70109	114.258	175.405
429.49	5.62405	107.027	177.808
429.326	5.62405	97.5273	177.808
429.162	5.6722	88.6055	176.298
428.998	5.62405	113.949	177.808
428.834	5.287	66.1211	189.143
428.67	4.61288	106.438	216.784
428.506	4.17953	70.2773	239.261
428.342	3.61135	96.9727	276.905
428.178	3.28392	77.1563	304.514
428.014	2.97576	57.3164	336.049
427.85	2.35943	60.5547	423.831
427.686	1.82977	60.4121	546.516
427.522	2.38832	80.1563	418.704
427.358	3.07206	49.7891	325.514
427.194	3.97729	50.0605	251.427
427.03	5.05587	55.3145	197.79
426.866	5.78776	26.8545	172.778
426.702	6.71226	48.8672	148.981
426.538	7.89677	50.4473	126.634
426.374	9.49537	43.6953	105.314
426.21	11.6814	37.1953	85.6061
426.046	12.5674	44	79.571
425.882	12.6926	47.0508	78.7862
425.718	14.0697	38.9277	71.0748
425.554	13.9156	37.7559	71.8617
425.389	13.8289	34.6211	72.3121
425.225	13.28	31.1992	75.3011
425.061	11.5466	44.5215	86.6056
424.897	10.6799	30.6572	93.634
424.733	9.52426	32.6699	104.995
424.569	8.73459	39.0391	114.487
424.405	8.04122	52.7031	124.359
424.241	8.62866	28.5615	115.893
424.077	9.08127	48.3379	110.117
423.913	8.76348	40.1953	114.11
423.749	7.94492	47.0898	125.867
423.585	7.38637	38.5586	135.385

423.421	6.75078	36.8066	148.131
423.257	6.0863	36.6445	164.303
423.093	5.8648	38.4023	170.509
422.929	5.65294	32.0508	176.899
422.765	5.49886	35.3164	181.856
422.601	5.24847	33.4824	190.532
422.437	5.33515	50.1992	187.436
422.273	5.3833	45.3887	185.76
422.109	5.27737	33.75	189.488
421.945	5.40256	40.3555	185.098
421.781	5.23884	25.0508	190.882
421.617	4.99809	45.1191	200.076
421.453	5.04624	28.668	198.167
421.288	5.02698	37.6543	198.927
421.124	5.21958	46.6543	191.586
420.96	4.56473	29.3467	219.071
420.796	4.46843	43.3086	223.792
420.632	4.61288	42.6797	216.784
420.468	4.86327	32.4336	205.623
420.304	4.86327	39.4297	205.623
420.14	4.85364	25.4297	206.031
419.976	4.92105	40.3652	203.209
419.812	4.86327	38.4805	205.623
419.648	4.75734	38.6621	210.202
419.484	4.73808	45.707	211.056
419.32	4.18916	47.0723	238.711
419.156	3.88099	39.9941	257.666
418.992	3.99656	33.3574	250.215
418.828	4.57436	36.9512	218.61
418.664	4.63215	36.9688	215.883
418.5	4.47806	33.4121	223.311
418.336	4.61288	48.1289	216.784
418.172	4.76697	38.2246	209.777
418.008	4.56473	36.9785	219.071
417.844	4.69956	27.0928	212.786
417.68	4.66104	43.9961	214.545
417.516	4.61288	60.4668	216.784
417.351	4.63215	26.8223	215.883
417.187	4.60325	45.4434	217.238
417.023	4.92105	54.4355	203.209
416.859	4.89216	44.4121	204.409
416.695	4.82475	49.6738	207.265
416.531	4.39139	44.5898	227.718
416.367	4.00619	44.6484	249.614
416.203	3.97729	43.0938	251.427
416.039	4.27583	41.0938	233.873
415.875	4.44917	42.377	224.761
415.711	4.66104	55.5801	214.545
415.547	4.95957	50.9453	201.63
415.383	5.17143	52.2109	193.37
415.219	5.27737	48.7793	189.488
415.055	4.95957	63.8184	201.63
414.891	4.85364	41.6445	206.031
414.727	4.46843	41.666	223.792
414.563	3.88099	26.8613	257.666
414.399	3.68839	62.3027	271.121
414.235	3.93877	63.6406	253.886
414.071	4.0736	55.0137	245.483
413.907	4.24694	55.2227	235.464
413.743	4.29509	63.9941	232.824
413.579	4.34324	47.2852	230.243
413.415	4.47806	47.1953	223.311
413.25	4.60325	53.4805	217.238
413.086	4.38176	55.3203	228.219
412.922	4.42028	53.873	226.23
412.758	4.28546	52.2383	233.347
412.594	4.29509	52.375	232.824
412.43	4.24694	64.8516	235.464

412.266	4.18916	46.4336	238.711
412.102	4.21805	62.3145	237.076
411.938	4.16027	53.5742	240.369
411.774	4.15064	75.1641	240.927
411.61	3.90988	52.6445	255.762
411.446	3.78469	67.6094	264.222
411.282	3.64024	84.3867	274.707
411.118	3.47653	49.0488	287.643
410.954	3.49579	80.6641	286.059
410.79	3.49579	50.2168	286.059
410.626	3.61135	45.2227	276.905
410.462	3.92914	61.9531	254.508
410.298	4.99809	64.293	200.076
410.134	5.44108	63.8418	183.787
409.97	4.73808	51.5801	211.056
409.806	4.10249	46.6035	243.755
409.642	4.41065	48.6016	226.724
409.478	5.59516	55.4824	178.726
409.314	6.39446	65.707	156.385
409.149	5.4796	55.5781	182.495
408.985	4.92105	57.4609	203.209
408.821	3.97729	49.1328	251.427
408.657	4.8729	47.1641	205.217
408.493	7.93529	47.0332	126.019
408.329	5.34478	48.7012	187.099
408.165	6.50039	62.4531	153.837
408.001	7.70416	44.5723	129.8
407.837	4.8729	29.4287	205.217
407.673	5.18106	39.6855	193.011
407.509	5.99	42.7383	166.945
407.345	6.40409	28.834	156.15
407.181	6.25964	44.3555	159.754
407.017	6.95301	44.4004	143.823
406.853	8.07011	44.1426	123.914
406.689	8.47457	38.6387	118
406.525	8.5131	38.4512	117.466
406.361	7.80046	50.3809	128.197
406.197	7.63675	40.2988	130.946
406.033	7.96418	26.7275	125.562
405.869	7.396	43.3477	135.208
405.705	7.36711	46.752	135.738
405.541	7.29007	48.5645	137.173
405.377	7.80046	41.916	128.197
405.212	7.64638	38.5391	130.781
405.048	7.22266	53.7949	138.453
404.884	6.17297	45.291	161.997
404.72	5.41219	42.1855	184.768
404.556	4.93068	28.9248	202.812
404.392	4.70919	38.8438	212.351
404.228	4.79586	40.2402	208.513
404.064	4.48769	36.8105	222.832
403.9	4.72845	43.8828	211.486
403.736	4.92105	42.9355	203.209
403.572	4.76697	46.7715	209.777
403.408	4.70919	39.7461	212.351
403.244	4.86327	37.8047	205.623
403.08	4.80549	41.0449	208.095
402.916	4.85364	35.9297	206.031
402.752	4.83438	40.9316	206.852
402.588	4.94994	45.6484	202.023
402.424	4.93068	42.0488	202.812
402.26	4.90179	31.7422	204.007
402.096	5.05587	46.9336	197.79
401.932	4.80549	54.0625	208.095
401.768	4.95957	55.4219	201.63
401.604	4.94994	66.7188	202.023
401.44	4.95957	46.8125	201.63
401.276	4.86327	62.0352	205.623

401.111	4.82475	84.0664	207.265
400.947	4.58399	76.668	218.15
400.783	4.86327	69.7617	205.623
400.619	4.10249	65.0586	243.755
400.455	4.54547	80.8086	219.999
400.291	3.77506	88.8164	264.896
400.127	4.31435	86.5469	231.785
399.963	5.0655	60.3691	197.414
399.799	5.56627	73.8594	179.654
399.635	6.32705	84.5859	158.052
399.471	6.77967	71.1563	147.5
399.307	2.88909	63.2871	346.13
399.143	0.991948	65.2617	1008.12
398.979	0.808976	58.4219	1236.13
398.815	1.20381	50.0156	830.695
398.651	1.31937	61.8613	757.935
398.487	5.44108	46.4238	183.787
398.323	9.01386	64.9297	110.94
398.159	10.2465	74.2734	97.5941
397.995	10.8532	54.0137	92.1385
397.831	10.8821	50.375	91.8939
397.667	9.39907	62.1543	106.394
397.503	8.69607	55.332	114.994
397.339	8.28197	49.7949	120.744
397.175	6.25964	71.8281	159.754
397.01	1.25196	82.207	798.746
396.846	-0.259971	56.9473	-3846.58
396.682	2.30165	81.7109	434.471
396.518	4.75734	90.0469	210.202
396.354	6.64485	92.1523	150.493
396.19	8.43605	84.3672	118.539
396.026	10.1984	72.8164	98.0549
395.862	11.4599	98.3477	87.2606
395.698	12.2496	112.609	81.6354
395.534	12.3074	95.6602	81.2521
395.37	11.7777	126.281	84.9061
395.206	10.9495	130.281	91.3282
395.042	10.8532	106.992	92.1385
394.878	11.0747	105.625	90.2958
394.714	11.0362	114.965	90.6109
394.55	11.3155	138.492	88.3746
394.386	11.5755	132.336	86.3895
394.222	11.874	123.211	84.2175
394.058	12.2785	110.551	81.4433
393.894	12.9333	135.813	77.3196
393.73	13.5111	121.012	74.013
393.566	14.0793	164.008	71.0261
393.402	14.6186	179.516	68.406
393.238	15.206	148.844	65.7633
393.074	15.9379	189.406	62.7434
392.909	16.9491	180.125	59.0002
392.745	17.9603	239.211	55.6784
392.581	18.8559	202.734	53.0339
392.417	19.8382	216.992	50.4079
392.253	20.4834	281.031	48.8201
392.089	21.379	266	46.7749
391.925	22.1975	294.844	45.05
391.761	22.7561	254.797	43.9443
391.597	23.3339	250.68	42.8561
391.433	23.9117	275.453	41.8205
391.269	24.4414	282.094	40.9142
391.105	25.0577	265.797	39.9079
390.941	25.78	276.719	38.7898
390.777	26.3	277.234	38.0228
390.613	27.0126	274.391	37.0197
390.449	27.4556	263.484	36.4224
390.285	28.0334	321.328	35.6717
390.121	28.5053	286.891	35.0812

389.957	28.0623	310.703	35.635
389.793	27.6482	298.813	36.1687
389.629	26.6563	261.703	37.5146
389.465	25.2696	301.688	39.5733
389.301	23.4591	356.984	42.6274
389.137	21.4753	301.156	46.5652
388.972	19.4433	225.148	51.4316
388.808	17.6906	327.5	56.5271
388.644	16.1305	265.906	61.9942
388.48	14.7534	282.641	67.7808
388.316	13.54	291.797	73.8551
388.152	12.5385	252.5	79.7544
387.988	11.6236	283.422	86.0316
387.824	10.8243	272.156	92.3845
387.66	10.3236	279.547	96.8658
387.496	9.6976	304.375	103.118
387.332	9.18721	301.438	108.847
387.168	8.85978	305.328	112.87
387.004	8.45531	291.016	118.269
386.84	8.2916	308.359	120.604
386.676	8.0027	248.891	124.958
386.512	7.82935	306.75	127.724
386.348	7.67527	233.406	130.289
386.184	7.67527	262.047	130.289
386.02	7.48267	305.234	133.642
385.856	7.25155	293.625	137.902
385.692	7.09746	279.156	140.895
385.528	7.04931	268.906	141.858
385.364	6.94338	305.234	144.022
385.2	6.81819	260.516	146.667
385.036	6.84708	272.625	146.048
384.871	6.74115	270.891	148.343
384.707	6.72189	304.266	148.768
384.543	6.76041	307.641	147.92
384.379	6.693	289.094	149.41
384.215	6.62559	249.031	150.93
384.051	6.55818	251.875	152.481
383.887	6.55818	252.836	152.481
383.723	6.52928	326.469	153.156
383.559	6.4715	293.313	154.524
383.395	6.40409	262.797	156.15
383.231	6.29816	292.406	158.777
383.067	6.29816	308.219	158.777
382.903	6.29816	251.578	158.777
382.739	6.33668	271.578	157.811
382.575	6.17297	275.281	161.997
382.411	6.23075	305.406	160.494
382.247	6.03815	284.734	165.614
382.083	5.91296	262.453	169.12
381.919	5.8648	309.109	170.509
381.755	5.94185	267.922	168.298
381.591	5.5759	263.781	179.343
381.427	5.7685	283.344	173.355
381.263	5.8648	252.242	170.509
381.099	5.69146	288.391	175.702
380.935	5.63368	287.172	177.504
380.77	5.69146	282.297	175.702
380.606	5.72998	172.602	174.521
380.442	5.6722	270	176.298
380.278	5.56627	229.039	179.654
380.114	5.53738	256.297	180.591
379.95	5.41219	190.672	184.768
379.786	5.50849	233.5	181.538
379.622	5.55664	242.047	179.965
379.458	5.50849	222.242	181.538
379.294	5.287	192.313	189.143
379.13	5.46034	232.438	183.139
378.966	5.46997	216.219	182.816

378.802	5.49886	262.656	181.856
378.638	5.44108	230.695	183.787
378.474	5.37367	255.328	186.093
378.31	5.30626	231.719	188.457
378.146	5.287	228.984	189.143
377.982	5.31589	243.375	188.115
377.818	5.34478	221.305	187.099
377.654	5.3833	271.016	185.76
377.49	5.3833	222.414	185.76
377.326	5.46034	248.352	183.139
377.162	5.44108	232.617	183.787
376.998	5.46997	254.523	182.816
376.834	5.46997	261.859	182.816
376.669	5.46034	284.672	183.139
376.505	5.46034	247.469	183.139
376.341	5.55664	242.82	179.965
376.177	5.66257	268.391	176.598
376.013	5.84554	232.984	171.07
375.849	5.98037	244.586	167.214
375.685	5.85517	249.641	170.789
375.521	5.91296	264.609	169.12
375.357	5.99	270.969	166.945
375.193	6.04778	219.609	165.35
375.029	5.79739	230.734	172.491
374.865	5.95148	273.641	168.026
374.701	6.03815	270.234	165.614
374.537	6.10556	241.734	163.785
374.373	6.32705	251.5	158.052
374.209	6.11519	270.266	163.527
374.045	6.21149	257.422	160.992
373.881	6.13445	236.875	163.014
373.717	6.23075	248.672	160.494
373.553	6.1826	254.789	161.744
373.389	6.21149	268.938	160.992
373.225	6.32705	273.578	158.052
373.061	6.15371	222.633	162.504
372.897	6.21149	235.219	160.992
372.732	6.10556	260.313	163.785
372.568	6.2789	262.531	159.264
372.404	6.10556	253.078	163.785
372.24	6.21149	313.891	160.992
372.076	6.23075	257.016	160.494
371.912	6.21149	260.891	160.992
371.748	6.07667	227.375	164.564
371.584	6.14408	289.156	162.758
371.42	6.24038	240.141	160.247
371.256	6.25964	243.914	159.754
371.092	6.0863	219.258	164.303
370.928	6.05741	259.563	165.087
370.764	6.14408	318.219	162.758
370.6	6.20186	260.313	161.242
370.436	6.05741	254.82	165.087
370.272	6.23075	260.703	160.494
370.108	6.23075	290.453	160.494
369.944	6.21149	215.703	160.992
369.78	6.1826	257.719	161.744
369.616	6.17297	239.164	161.997
369.452	6.11519	273.766	163.527
369.288	6.36557	265.594	157.095
369.124	6.24038	241.164	160.247
368.96	6.33668	225.586	157.811
368.796	6.39446	258.234	156.385
368.631	6.36557	255.258	157.095
368.467	6.23075	251.656	160.494
368.303	6.33668	232.289	157.811
368.139	6.25964	267.5	159.754
367.975	6.2789	198.313	159.264
367.811	6.39446	250.641	156.385

367.647	6.2789	229.633	159.264
367.483	6.26927	233.781	159.508
367.319	6.20186	281.984	161.242
367.155	6.25964	222.133	159.754
366.991	6.13445	242	163.014
366.827	6.29816	256.234	158.777
366.663	6.36557	232.93	157.095
366.499	6.43298	265.859	155.449
366.335	6.3752	299.875	156.858
366.171	6.45224	270.891	154.985
366.007	6.3752	223.297	156.858
365.843	6.32705	245.648	158.052
365.679	6.40409	247.992	156.15
365.515	6.3752	231.789	156.858
365.351	6.46187	238.297	154.754
365.187	6.39446	230.57	156.385
365.023	6.49076	252.063	154.065
364.859	6.26927	266.078	159.508
364.695	6.36557	275.797	157.095
364.53	6.4715	236.539	154.524
364.366	6.43298	258.469	155.449
364.202	6.32705	224.859	158.052
364.038	6.2789	298.578	159.264
363.874	6.33668	276.844	157.811
363.71	6.43298	281.984	155.449
363.546	6.40409	221.375	156.15
363.382	6.52928	272.078	153.156
363.218	6.3752	297.594	156.858
363.054	6.39446	247.18	156.385
362.89	6.39446	287.875	156.385
362.726	6.43298	287.578	155.449
362.562	6.45224	231.844	154.985
362.398	6.30779	220.219	158.534
362.234	6.39446	267.063	156.385
362.07	6.35594	265.813	157.333
361.906	6.42335	282.828	155.682
361.742	6.4715	245.477	154.524
361.578	6.40409	241.711	156.15
361.414	6.45224	250.297	154.985
361.25	6.46187	262.797	154.754
361.086	6.40409	254.25	156.15
360.922	6.43298	255.695	155.449
360.758	6.35594	237.883	157.333
360.594	6.29816	221.805	158.777
360.429	6.4715	251.305	154.524
360.265	6.43298	269.609	155.449
360.101	6.43298	294.688	155.449
359.937	6.32705	223.008	158.052
359.773	6.36557	261.375	157.095
359.609	6.46187	291.469	154.754
359.445	6.46187	247.57	154.754
359.281	6.36557	264.859	157.095
359.117	6.52928	249.758	153.156
358.953	6.40409	239.586	156.15
358.789	6.42335	255.68	155.682
358.625	6.30779	251.336	158.534
358.461	6.29816	240.93	158.777
358.297	6.39446	266.313	156.385
358.133	6.29816	215.953	158.777
357.969	6.33668	242.875	157.811
357.805	6.3752	239.609	156.858
357.641	6.46187	212.469	154.754
357.477	6.35594	257.203	157.333
357.313	6.40409	253.961	156.15
357.149	6.42335	284.609	155.682
356.985	6.36557	270.469	157.095
356.821	6.75078	252.867	148.131
356.657	6.85671	291.969	145.843

356.493	6.46187	245.164	154.754
356.328	6.45224	284.922	154.985
356.164	6.45224	263.094	154.985
356	6.42335	261.109	155.682
355.836	6.4715	266.188	154.524
355.672	6.33668	255.211	157.811
355.508	6.4715	221.508	154.524
355.344	6.29816	231.938	158.777
355.18	6.23075	236.594	160.494
355.016	6.3752	246.508	156.858
354.852	6.29816	291.422	158.777
354.688	6.32705	248.664	158.052
354.524	6.32705	219.773	158.052
354.36	6.43298	278.016	155.449
354.196	6.40409	270.391	156.15
354.032	6.42335	248.711	155.682
353.868	6.42335	248.359	155.682
353.704	6.42335	243.516	155.682
353.54	6.56781	268.672	152.258
353.376	6.50039	266.438	153.837
353.212	6.3752	261.859	156.858
353.048	6.36557	264.766	157.095
352.884	6.39446	238.531	156.385
352.72	6.40409	241.922	156.15
352.556	6.32705	223.273	158.052
352.391	6.26927	262.625	159.508
352.227	6.51965	235.844	153.382
352.063	6.42335	240.961	155.682
351.899	6.43298	248.953	155.449
351.735	6.36557	259.391	157.095
351.571	6.40409	259.406	156.15
351.407	6.46187	283.375	154.754
351.243	6.39446	241.289	156.385
351.079	6.3752	194.82	156.858
350.915	6.24038	284.688	160.247
350.751	6.29816	235.078	158.777
350.587	6.30779	188.984	158.534
350.423	6.45224	272.953	154.985
350.259	6.30779	238.055	158.534
350.095	6.36557	196.898	157.095
349.931	6.3752	235.711	156.858
349.767	6.32705	214.969	158.052
349.603	6.3752	223.297	156.858
349.439	6.52928	254.742	153.156
349.275	6.55818	229.945	152.481
349.111	6.50039	256.344	153.837
348.947	6.43298	251.086	155.449
348.783	6.50039	232.641	153.837
348.619	6.42335	260.828	155.682
348.455	6.39446	257.688	156.385
348.29	6.42335	276.094	155.682
348.126	6.43298	282.016	155.449
347.962	6.32705	251.234	158.052
347.798	6.42335	289.75	155.682
347.634	6.54854	222.93	152.706
347.47	6.40409	280.641	156.15
347.306	6.33668	295.594	157.811
347.142	6.36557	254.289	157.095
346.978	6.33668	245.867	157.811
346.814	6.4715	238.922	154.524
346.65	6.21149	222.68	160.992
346.486	6.50039	241.813	153.837
346.322	6.42335	274.938	155.682
346.158	6.33668	266.922	157.811
345.994	6.49076	241.625	154.065
345.83	6.39446	252.773	156.385
345.666	6.45224	220.453	154.985
345.502	6.42335	211.602	155.682

345.338	6.54854	209.414	152.706
345.174	6.39446	230.539	156.385
345.01	6.33668	257.172	157.811
344.846	6.39446	247.492	156.385
344.682	6.43298	244.813	155.449
344.518	6.49076	232.68	154.065
344.354	6.56781	216.492	152.258
344.189	6.54854	274	152.706
344.025	6.36557	235.234	157.095
343.861	6.40409	257.969	156.15
343.697	6.35594	264.797	157.333
343.533	6.33668	253.742	157.811
343.369	6.26927	301.344	159.508
343.205	6.33668	256.234	157.811
343.041	6.29816	232.641	158.777
342.877	6.45224	248.594	154.985
342.713	6.43298	216.336	155.449
342.549	6.2789	270.828	159.264
342.385	6.49076	226.992	154.065
342.221	6.46187	236.438	154.754
342.057	6.45224	254.578	154.985
341.893	6.51965	260.547	153.382
341.729	6.56781	248.438	152.258
341.565	6.54854	233.969	152.706
341.401	6.3752	238.336	156.858
341.237	6.4715	242.555	154.524
341.073	6.45224	237.273	154.985
340.909	6.46187	214.391	154.754
340.745	6.46187	232.781	154.754
340.581	6.64485	244.359	150.493
340.417	6.66411	242.281	150.058
340.253	6.49076	255.414	154.065
340.088	6.62559	212.758	150.93
339.924	6.4715	201.891	154.524
339.76	6.52928	259.938	153.156
339.596	6.46187	264.594	154.754
339.432	6.51965	209	153.382
339.268	6.58707	218.586	151.813
339.104	6.65448	264.125	150.275
338.94	6.58707	260.656	151.813
338.776	6.54854	224.055	152.706
338.612	6.61596	229.875	151.15
338.448	6.49076	292.422	154.065
338.284	6.4715	239.469	154.524
338.12	6.40409	249.211	156.15
337.956	6.50039	246.977	153.837
337.792	6.46187	244.594	154.754
337.628	6.55818	232.758	152.481
337.464	6.58707	222.102	151.813
337.3	6.56781	233.5	152.258
337.136	6.55818	259.984	152.481
336.972	6.58707	258.719	151.813
336.808	6.65448	223.641	150.275
336.644	6.64485	242.297	150.493
336.48	6.64485	254.055	150.493
336.316	6.87597	253.961	145.434
336.151	7.09746	240.234	140.895
335.987	6.97227	234.797	143.425
335.823	6.68337	247.633	149.625
335.659	6.61596	267.813	151.15
335.495	6.65448	293.641	150.275
335.331	6.65448	262.156	150.275
335.167	6.43298	229.031	155.449
335.003	6.61596	249.75	151.15
334.839	6.693	223.492	149.41
334.675	6.65448	254.148	150.275
334.511	6.54854	230.539	152.706
334.347	6.45224	251.445	154.985

334.183	6.62559	266.781	150.93
334.019	6.45224	257.766	154.985
333.855	6.49076	244.141	154.065
333.691	6.52928	238	153.156
333.527	6.46187	225.328	154.754
333.363	6.68337	292.172	149.625
333.199	6.50039	284.563	153.837
333.035	6.61596	251.305	151.15
332.871	6.55818	235.664	152.481
332.707	6.50039	257.859	153.837
332.543	6.50039	233.328	153.837
332.379	6.40409	241.266	156.15
332.215	6.33668	255.391	157.811
332.05	6.35594	241.234	157.333
331.886	6.33668	277.281	157.811
331.722	6.42335	266.406	155.682
331.558	6.52928	242.555	153.156
331.394	6.50039	230.328	153.837
331.23	6.56781	241.602	152.258
331.066	6.39446	215.352	156.385
330.902	6.24038	291.203	160.247
330.738	6.40409	222.609	156.15
330.574	6.36557	209.266	157.095
330.41	6.30779	234.953	158.534
330.246	6.39446	228.75	156.385
330.082	6.39446	208.836	156.385
329.918	6.64485	262.734	150.493
329.754	6.45224	250.195	154.985
329.59	6.42335	246.672	155.682
329.426	6.24038	198.219	160.247
329.262	6.25964	224.125	159.754
329.098	6.30779	223.617	158.534
328.934	6.40409	202.008	156.15
328.77	6.36557	232.82	157.095
328.606	6.42335	225.555	155.682
328.442	6.50039	226.914	153.837
328.278	6.30779	256.891	158.534
328.114	6.33668	226.711	157.811
327.949	6.33668	254.781	157.811
327.785	6.45224	236.227	154.985
327.621	6.3752	239.352	156.858
327.457	6.33668	231.188	157.811
327.293	6.50039	251.961	153.837
327.129	6.40409	237.656	156.15
326.965	6.30779	253.422	158.534
326.801	6.24038	274.328	160.247
326.637	6.29816	276.094	158.777
326.473	6.43298	240.43	155.449
326.309	6.39446	240.141	156.385
326.145	6.54854	251.93	152.706
325.981	6.5967	231.32	151.591
325.817	6.52928	268.813	153.156
325.653	6.40409	243.102	156.15
325.489	6.43298	215.859	155.449
325.325	6.43298	224.813	155.449
325.161	6.33668	221.016	157.811
324.997	6.56781	226.625	152.258
324.833	6.50039	248.586	153.837
324.669	6.49076	233.891	154.065
324.505	6.46187	245.672	154.754
324.341	6.55818	257.141	152.481
324.177	6.7893	240.305	147.291
324.013	6.46187	258.234	154.754
323.848	6.46187	244.648	154.754
323.684	6.42335	284.688	155.682
323.52	6.62559	253.641	150.93
323.356	6.58707	235.133	151.813
323.192	6.4715	249.5	154.524

323.028	6.64485	261.844	150.493
322.864	6.61596	275.594	151.15
322.7	6.76041	204.125	147.92
322.536	7.22266	279.516	138.453
322.372	6.72189	239.922	148.768
322.208	6.55818	237.031	152.481
322.044	6.51965	241.625	153.382
321.88	6.58707	251.703	151.813
321.716	6.54854	263.578	152.706
321.552	6.50039	211.875	153.837
321.388	6.35594	219.063	157.333
321.224	6.4715	217.281	154.524
321.06	6.39446	257.828	156.385
320.896	6.3752	209.672	156.858
320.732	6.52928	253.617	153.156
320.568	6.56781	242.141	152.258
320.404	6.54854	256.781	152.706
320.24	6.49076	267.813	154.065
320.076	6.3752	251.367	156.858
319.912	6.46187	231.508	154.754
319.747	6.43298	227.063	155.449
319.583	6.49076	234.781	154.065
319.419	6.75078	236.102	148.131
319.255	6.5967	216.602	151.591
319.091	6.52928	224.984	153.156
318.927	6.693	228.938	149.41
318.763	6.54854	232.211	152.706
318.599	6.55818	220.727	152.481
318.435	6.56781	215.078	152.258
318.271	6.62559	253.07	150.93
318.107	6.51965	257.266	153.382
317.943	6.4715	266.469	154.524
317.779	6.42335	211.313	155.682
317.615	6.56781	255.461	152.258
317.451	6.5967	236.43	151.591
317.287	6.72189	242.016	148.768
317.123	6.62559	232.992	150.93
316.959	6.65448	249.125	150.275
316.795	6.55818	237.328	152.481
316.631	6.4715	222.289	154.524
316.467	6.40409	244.922	156.15
316.303	6.65448	222.734	150.275
316.139	6.72189	217.383	148.768
315.975	6.56781	276.094	152.258
315.811	6.54854	261.734	152.706
315.646	6.50039	238.273	153.837
315.482	6.58707	273.125	151.813
315.318	6.49076	242.789	154.065
315.154	6.49076	262.484	154.065
314.99	6.58707	229.68	151.813
314.826	6.55818	261.641	152.481
314.662	6.49076	278.25	154.065
314.498	6.40409	226.883	156.15
314.334	6.3752	247.344	156.858
314.17	6.46187	232.625	154.754
314.006	6.45224	238.57	154.985
313.842	6.68337	259	149.625
313.678	6.87597	269.375	145.434
313.514	6.5967	240.375	151.591
313.35	6.52928	249.758	153.156
313.186	6.5967	244.898	151.591
313.022	6.51965	235.055	153.382
312.858	6.51965	208.93	153.382
312.694	6.58707	202.195	151.813
312.53	6.64485	222.594	150.493
312.366	6.54854	235.289	152.706
312.202	6.4715	253.648	154.524
312.038	6.36557	235.172	157.095

311.874	6.42335	231.523	155.682
311.71	6.66411	215.625	150.058
311.545	6.39446	239.508	156.385
311.381	6.40409	248.516	156.15
311.217	6.21149	213.836	160.992
311.053	6.2789	268.047	159.264
310.889	6.43298	271.078	155.449
310.725	6.46187	220.266	154.754
310.561	6.39446	222.398	156.385
310.397	6.3752	219.789	156.858
310.233	6.45224	227.844	154.985
310.069	6.50039	213.25	153.837
309.905	6.33668	211.961	157.811
309.741	6.29816	252.148	158.777
309.577	6.36557	257.25	157.095
309.413	6.32705	250.461	158.052
309.249	6.32705	273.063	158.052
309.085	6.36557	238.148	157.095
308.921	6.30779	251.289	158.534
308.757	6.42335	234.625	155.682
308.593	6.2789	219.805	159.264
308.429	6.30779	229.633	158.534
308.265	6.32705	214.805	158.052
308.101	6.40409	210.086	156.15
307.937	6.29816	243.594	158.777
307.773	6.21149	225.773	160.992
307.608	6.15371	237.242	162.504
307.444	6.21149	204.906	160.992
307.28	6.25964	227.172	159.754
307.116	6.32705	237.414	158.052
306.952	6.1826	250.461	161.744
306.788	6.33668	187.125	157.811
306.624	6.24038	246.203	160.247
306.46	6.20186	250.109	161.242
306.296	6.20186	229.82	161.242
306.132	6.2789	209.234	159.264
305.968	6.26927	243.578	159.508
305.804	6.55818	270.781	152.481
305.64	6.46187	203.617	154.754
305.476	6.20186	240.57	161.242
305.312	6.23075	250.461	160.494
305.148	6.14408	210.586	162.758
304.984	6.32705	251.336	158.052
304.82	6.72189	246.953	148.768
304.656	6.40409	206.789	156.15
304.492	6.25964	263.641	159.754
304.328	6.26927	241.156	159.508
304.164	6.33668	251.859	157.811
304	6.21149	251.695	160.992
303.836	6.29816	234.672	158.777
303.672	6.35594	243.906	157.333
303.507	6.35594	219.727	157.333
303.343	6.25964	234.273	159.754
303.179	6.2789	227.719	159.264
303.015	6.21149	218.57	160.992
302.851	6.21149	270.5	160.992
302.687	6.32705	216.164	158.052
302.523	6.3752	236.586	156.858
302.359	6.43298	282.766	155.449
302.195	6.4715	220.453	154.524
302.031	6.33668	245.445	157.811
301.867	6.1826	209.773	161.744
301.703	6.26927	271.484	159.508
301.539	5.98037	215.414	167.214
301.375	6.29816	237.898	158.777
301.211	6.29816	238.352	158.777
301.047	6.20186	249.023	161.242
300.883	6.20186	243.5	161.242

300.719	6.24038	271.938	160.247
300.555	6.13445	219.531	163.014
300.391	6.25964	216.922	159.754
300.227	6.13445	250.773	163.014
300.063	6.25964	241.063	159.754
299.899	6.15371	236.828	162.504
299.735	6.2789	232.281	159.264
299.571	6.26927	204.711	159.508
299.406	6.33668	254.602	157.811
299.242	6.10556	229.688	163.785
299.078	6.21149	199.961	160.992
298.914	6.23075	254.859	160.494
298.75	6.10556	231.031	163.785
298.586	6.25964	251.484	159.754
298.422	6.17297	229.117	161.997
298.258	6.24038	210.43	160.247
298.094	6.10556	249.422	163.785
297.93	6.11519	221.945	163.527
297.766	6.30779	266.813	158.534
297.602	6.1826	243.234	161.744
297.438	6.13445	270.813	163.014
297.274	5.95148	250.398	168.026
297.11	6.01889	255.305	166.144
296.946	6.00926	263.672	166.41
296.782	6.00926	223.555	166.41
296.618	5.99	251.602	166.945
296.454	6.25964	235.086	159.754
296.29	6.13445	259.313	163.014
296.126	6.20186	240.719	161.242
295.962	6.17297	262.516	161.997
295.798	6.14408	240.625	162.758
295.634	6.1826	228.656	161.744
295.47	6.04778	240.391	165.35
295.305	6.24038	201.078	160.247
295.141	6.24038	222.852	160.247
294.977	6.15371	234.313	162.504
294.813	6.25964	201.555	159.754
294.649	6.30779	274	158.534
294.485	6.20186	236.102	161.242
294.321	6.11519	232.469	163.527
294.157	5.99	249.148	166.945
293.993	6.23075	218.992	160.494
293.829	6.17297	252.383	161.997
293.665	6.13445	213.805	163.014
293.501	6.32705	222.133	158.052
293.337	6.23075	234.836	160.494
293.173	6.13445	257.813	163.014
293.009	6.00926	265.453	166.41
292.845	6.01889	265.766	166.144
292.681	5.95148	255.156	168.026
292.517	6.1826	243.359	161.744
292.353	6.11519	223.383	163.527
292.189	6.03815	225.695	165.614
292.025	6.05741	258.938	165.087
291.861	6.15371	250.195	162.504
291.697	6.23075	235.086	160.494
291.533	6.21149	240.016	160.992
291.368	6.32705	215.719	158.052
291.204	6.32705	213.57	158.052
291.04	6.35594	279.813	157.333
290.876	6.26927	234.82	159.508
290.712	6.30779	231.813	158.534
290.548	6.21149	261.141	160.992
290.384	6.20186	210.969	161.242
290.22	6.32705	203.047	158.052
290.056	6.25964	239.922	159.754
289.892	6.33668	227.844	157.811
289.728	6.36557	261.266	157.095

289.564	6.05741	217.625	165.087
289.4	6.40409	216.445	156.15
289.236	6.26927	235.891	159.508
289.072	6.33668	253.016	157.811
288.908	6.21149	218.859	160.992
288.744	6.1826	203.57	161.744
288.58	6.23075	226.414	160.494
288.416	6.32705	262.391	158.052
288.252	6.21149	244.352	160.992
288.088	6.2789	234.133	159.264
287.924	6.11519	234.391	163.527
287.76	6.1826	234.977	161.744
287.596	6.21149	243.93	160.992
287.432	6.30779	214.391	158.534
287.267	6.2789	226.789	159.264
287.103	6.23075	226.68	160.494
286.939	6.25964	209.648	159.754
286.775	6.17297	214.211	161.997
286.611	6.26927	261.781	159.508
286.447	6.50039	223.438	153.837
286.283	6.1826	194.172	161.744
286.119	6.24038	239.727	160.247
285.955	6.25964	249.211	159.754
285.791	6.10556	229.219	163.785
285.627	6.32705	215.805	158.052
285.463	6.21149	211.359	160.992
285.299	6.26927	228.523	159.508
285.135	6.14408	229.852	162.758
284.971	6.24038	202.711	160.247
284.807	6.26927	220.297	159.508
284.643	6.2789	210.508	159.264
284.479	6.2789	230.445	159.264
284.315	6.23075	246.18	160.494
284.151	6.39446	220.344	156.385
283.987	6.36557	228.563	157.095
283.823	6.13445	245.852	163.014
283.659	6.20186	215.367	161.242
283.495	6.21149	230.414	160.992
283.331	6.29816	221.102	158.777
283.166	6.25964	225.453	159.754
283.002	6.36557	248.867	157.095
282.838	6.33668	244.773	157.811
282.674	6.21149	213.352	160.992
282.51	6.36557	212.094	157.095
282.346	6.32705	229.586	158.052
282.182	6.11519	228.641	163.527
282.018	6.29816	228.938	158.777
281.854	6.30779	255.055	158.534
281.69	6.20186	259.781	161.242
281.526	6.20186	207.211	161.242
281.362	6.2789	274.672	159.264
281.198	6.20186	242.297	161.242
281.034	6.15371	194.047	162.504
280.87	6.21149	206.797	160.992
280.706	6.14408	203.523	162.758
280.542	6.21149	231.148	160.992
280.378	6.20186	197.867	161.242
280.214	6.13445	278.172	163.014
280.05	6.14408	245.523	162.758
279.886	6.11519	197.766	163.527
279.722	6.11519	213.203	163.527
279.558	6.17297	242.906	161.997
279.394	6.23075	228.367	160.494
279.23	6.14408	194.328	162.758
279.065	6.10556	214.641	163.785
278.901	6.23075	251.547	160.494
278.737	6.11519	222.992	163.527
278.573	6.11519	181.055	163.527

278.409	6.23075	209.703	160.494
278.245	6.20186	244.195	161.242
278.081	6.10556	195.477	163.785
277.917	6.00926	274.484	166.41
277.753	6.05741	236.234	165.087
277.589	6.07667	227.406	164.564
277.425	6.15371	273.5	162.504
277.261	6.05741	218.469	165.087
277.097	6.05741	208.367	165.087
276.933	6.1826	244.297	161.744
276.769	6.10556	248.219	163.785
276.605	5.99	225.953	166.945
276.441	6.11519	220.219	163.527
276.277	6.03815	204.25	165.614
276.113	6.15371	225.633	162.504
275.949	6.21149	239.609	160.992
275.785	6.0863	230.023	164.303
275.621	6.1826	216.602	161.744
275.457	6.13445	247.023	163.014
275.293	6.26927	202.305	159.508
275.128	6.05741	253.328	165.087
274.964	5.96111	224.258	167.754
274.8	6.07667	226.102	164.564
274.636	6.14408	213.938	162.758
274.472	5.98037	232.602	167.214
274.308	6.01889	205.602	166.144
274.144	5.91296	227.219	169.12
273.98	6.00926	223.18	166.41
273.816	6.15371	218.492	162.504
273.652	5.98037	220.891	167.214
273.488	6.00926	195.172	166.41
273.324	6.15371	199.813	162.504
273.16	6.07667	221.32	164.564
272.996	6.04778	223.047	165.35
272.832	6.10556	204.75	163.785
272.668	6.00926	229.297	166.41
272.504	6.07667	203.695	164.564
272.34	6.17297	235.633	161.997
272.176	6.14408	243.086	162.758
272.012	6.0863	249.242	164.303
271.848	6.14408	252.602	162.758
271.684	6.11519	205.438	163.527
271.52	6.23075	238.773	160.494
271.356	6.04778	225.945	165.35
271.192	6.21149	238.781	160.992
271.027	6.0863	252.188	164.303
270.863	6.10556	204.07	163.785
270.699	6.14408	212.766	162.758
270.535	5.99	242.25	166.945
270.371	5.98037	250.227	167.214
270.207	5.98037	232.445	167.214
270.043	5.98037	230.547	167.214
269.879	6.03815	225.352	165.614
269.715	6.24038	229.43	160.247
269.551	6.1826	202.922	161.744
269.387	6.21149	246.508	160.992
269.223	6.07667	201.367	164.564
269.059	6.10556	245.656	163.785
268.895	6.04778	228.953	165.35
268.731	5.89369	246.281	169.673
268.567	5.99	246.344	166.945
268.403	5.95148	223.828	168.026
268.239	6.11519	241.547	163.527
268.075	5.99	206.188	166.945
267.911	6.0863	226.18	164.303
267.747	5.96111	277.016	167.754
267.583	5.96111	249.109	167.754
267.419	6.04778	227.281	165.35

267.255	5.95148	241.219	168.026
267.091	6.00926	230.266	166.41
266.926	6.04778	258.578	165.35
266.762	5.88406	209.813	169.951
266.598	5.88406	243.602	169.951
266.434	6.01889	239.344	166.144
266.27	5.88406	254.469	169.951
266.106	5.8648	196.984	170.509
265.942	6.24038	228.055	160.247
265.778	5.99	220.531	166.945
265.614	6.14408	235.078	162.758
265.45	6.0863	227.578	164.303
265.286	6.36557	209.25	157.095
265.122	6.13445	253.148	163.014
264.958	6.1826	216	161.744
264.794	5.78776	262.266	172.778
264.63	5.89369	203.023	169.673
264.466	5.98037	247.242	167.214
264.302	5.94185	234.43	168.298
264.138	6.03815	215.227	165.614
263.974	5.81665	243.023	171.92
263.81	5.88406	206.008	169.951
263.646	5.95148	225.172	168.026
263.482	5.89369	227.977	169.673
263.318	5.89369	219.414	169.673
263.154	6.01889	209.328	166.144
262.99	5.89369	219.773	169.673
262.825	6.03815	257.594	165.614
262.661	5.88406	258.531	169.951
262.497	5.96111	245.438	167.754
262.333	6.03815	232.664	165.614
262.169	6.04778	220.938	165.35
262.005	5.95148	254.453	168.026
261.841	5.8648	230.266	170.509
261.677	5.91296	257.516	169.12
261.513	6.07667	181.141	164.564
261.349	5.82628	230.258	171.636
261.185	5.8648	219.25	170.509
261.021	5.96111	198.117	167.754
260.857	6.10556	220.273	163.785
260.693	5.98037	212.625	167.214
260.529	5.94185	200.023	168.298
260.365	6.03815	198.531	165.614
260.201	5.99	223.688	166.945
260.037	5.84554	250.141	171.07
259.873	5.95148	241.609	168.026
259.709	5.89369	211.266	169.673
259.545	5.89369	231.766	169.673
259.381	5.82628	222.852	171.636
259.217	5.89369	273.141	169.673
259.053	5.85517	230.328	170.789
258.888	5.8648	219.539	170.509
258.724	5.96111	235.008	167.754
258.56	5.94185	224.023	168.298
258.396	5.82628	226.242	171.636
258.232	5.85517	235.063	170.789
258.068	5.8648	218.313	170.509
257.904	5.8648	226.078	170.509
257.74	5.75887	226.734	173.645
257.576	5.95148	249.313	168.026
257.412	6.01889	188.805	166.144
257.248	5.79739	212.602	172.491
257.084	5.84554	227.359	171.07
256.92	5.88406	210.016	169.951
256.756	5.85517	224.555	170.789
256.592	5.82628	211.258	171.636
256.428	5.89369	218.234	169.673
256.264	5.89369	211.289	169.673

256.1	6.04778	233.016	165.35
255.936	6.21149	209.641	160.992
255.772	6.07667	223.695	164.564
255.608	5.98037	200.375	167.214
255.444	6.33668	237.742	157.811
255.28	5.99	232.148	166.945
255.116	5.74924	238.023	173.936
254.952	5.98037	190.977	167.214
254.787	6.07667	206.617	164.564
254.623	6.04778	228.969	165.35
254.459	6.13445	231.586	163.014
254.295	6.25964	209.227	159.754
254.131	6.00926	222.867	166.41
253.967	5.99	222.914	166.945
253.803	5.99	244.953	166.945
253.639	6.11519	211.836	163.527
253.475	5.81665	230.305	171.92
253.311	5.99	211.234	166.945
253.147	6.17297	215.07	161.997
252.983	6.05741	195.063	165.087
252.819	6.0863	218.867	164.303
252.655	5.88406	219.125	169.951
252.491	6.0863	237.547	164.303
252.327	5.95148	233.391	168.026
252.163	6.00926	225.617	166.41
251.999	6.07667	237.086	164.564
251.835	6.00926	233.188	166.41
251.671	6.00926	166.273	166.41
251.507	6.11519	235.641	163.527
251.343	5.96111	175.391	167.754
251.179	6.00926	196.773	166.41
251.015	6.32705	189.484	158.052
250.851	5.94185	184.266	168.298
250.686	6.07667	200.43	164.564
250.522	6.04778	196.25	165.35
250.358	5.84554	211.016	171.07
250.194	5.85517	194.531	170.789
250.03	5.79739	177.039	172.491
249.866	6.03815	182.992	165.614
249.702	6.05741	196.664	165.087
249.538	5.99	227.164	166.945
249.374	6.30779	196.094	158.534
249.21	5.85517	235.313	170.789
249.046	6.0863	209.773	164.303
248.882	5.81665	187.172	171.92
248.718	5.7685	201.57	173.355
248.554	5.70109	195.68	175.405
248.39	5.7685	196.313	173.355
248.226	5.89369	225.82	169.673
248.062	5.85517	186.305	170.789
247.898	5.31589	226.414	188.115
247.734	5.53738	223.242	180.591
247.57	5.72035	191.859	174.814
247.406	5.98037	207.906	167.214
247.242	5.70109	204.188	175.405
247.078	5.72998	193.289	174.521
246.914	5.70109	220.594	175.405
246.75	5.82628	194.125	171.636
246.585	5.55664	206.789	179.965
246.421	5.6722	226.703	176.298
246.257	5.72998	222.555	174.521
246.093	5.46997	193.273	182.816
245.929	5.27737	209.336	189.488
245.765	5.43145	195.219	184.113
245.601	5.4796	195.266	182.495
245.437	5.60479	213.977	178.419
245.273	5.62405	214.664	177.808
245.109	5.55664	244.352	179.965

244.945	5.49886	213.742	181.856
244.781	5.60479	229.539	178.419
244.617	5.41219	210.063	184.768
244.453	5.4796	194.406	182.495
244.289	5.46997	204.047	182.816
244.125	5.41219	196.328	184.768
243.961	5.53738	180.328	180.591
243.797	5.46997	234.102	182.816
243.633	5.40256	187.992	185.098
243.469	5.4796	191.555	182.495
243.305	5.44108	243.422	183.787
243.141	5.33515	206.195	187.436
242.977	5.53738	185.719	180.591
242.813	5.40256	189.992	185.098
242.648	5.30626	182.414	188.457
242.484	5.4796	188.078	182.495
242.32	5.34478	214.086	187.099
242.156	5.53738	154.055	180.591
241.992	5.27737	212.625	189.488
241.828	5.41219	219.852	184.768
241.664	5.31589	209.406	188.115
241.5	5.287	216.508	189.143
241.336	5.36404	194.383	186.427
241.172	5.36404	185.297	186.427
241.008	5.23884	212.453	190.882
240.844	5.21958	204.484	191.586
240.68	5.36404	194.148	186.427
240.516	5.40256	210.352	185.098
240.352	5.3833	219.469	185.76
240.188	5.37367	225.008	186.093
240.024	5.24847	188.578	190.532
239.86	5.26774	194.75	189.835
239.696	5.27737	239.688	189.488
239.532	5.3833	198.867	185.76
239.368	5.3833	215.414	185.76
239.204	5.27737	178.242	189.488
239.04	5.40256	202.828	185.098
238.876	5.41219	221.984	184.768
238.712	5.55664	222.813	179.965
238.547	5.50849	185.063	181.538
238.383	5.33515	201.359	187.436
238.219	5.26774	161.828	189.835
238.055	5.36404	185.32	186.427
237.891	5.20995	197.945	191.94
237.727	5.287	194.273	189.143
237.563	5.33515	191.219	187.436
237.399	5.31589	213.43	188.115
237.235	5.31589	211.031	188.115
237.071	5.20995	227.797	191.94
236.907	5.24847	177.344	190.532
236.743	5.15217	192.25	194.093
236.579	5.12328	232.539	195.187
236.415	5.18106	207.422	193.011
236.251	5.21958	190.469	191.586
236.087	5.40256	186.93	185.098
235.923	5.40256	181.313	185.098
235.759	5.36404	204.477	186.427
235.595	5.287	174.508	189.143
235.431	5.23884	213.258	190.882
235.267	5.08476	204.711	196.666
235.103	5.17143	176.844	193.37
234.939	5.30626	193.242	188.457
234.775	5.18106	163.781	193.011
234.611	5.287	188.305	189.143
234.446	5.23884	182.438	190.882
234.282	5.27737	179.766	189.488
234.118	5.08476	184.055	196.666
233.954	5.24847	206.594	190.532

233.79	5.17143	217.93	193.37
233.626	5.15217	173.328	194.093
233.462	5.15217	169.68	194.093
233.298	5.31589	193.406	188.115
233.134	5.27737	207.906	189.488
232.97	5.3833	185.93	185.76
232.806	5.36404	171.117	186.427
232.642	5.26774	190.883	189.835
232.478	5.33515	183.305	187.436
232.314	5.40256	182.625	185.098
232.15	5.12328	213.367	195.187
231.986	5.23884	192.695	190.882
231.822	5.12328	167.227	195.187
231.658	5.287	203.695	189.143
231.494	5.26774	198.852	189.835
231.33	5.26774	172.156	189.835
231.166	5.287	216.82	189.143
231.002	5.40256	189.227	185.098
230.838	5.21958	205.57	191.586
230.674	5.18106	184.648	193.011
230.51	5.21958	194.75	191.586
230.345	5.0655	208.602	197.414
230.181	5.20995	196.102	191.94
230.017	5.24847	137.18	190.532
229.853	5.34478	233.719	187.099
229.689	5.18106	173.703	193.011
229.525	5.23884	205.289	190.882
229.361	5.287	213.25	189.143
229.197	5.36404	153.727	186.427
229.033	5.34478	204.117	187.099
228.869	5.19069	222.477	192.652
228.705	5.26774	181.797	189.835
228.541	5.41219	198.383	184.768
228.377	5.40256	189.352	185.098
228.213	5.20995	187.602	191.94
228.049	5.287	174.273	189.143
227.885	5.41219	169.328	184.768
227.721	5.40256	203.469	185.098
227.557	5.31589	220.5	188.115
227.393	5.34478	185.352	187.099
227.229	5.44108	187.742	183.787
227.065	5.20995	185.969	191.94
226.901	5.40256	218.836	185.098
226.737	5.33515	225.75	187.436
226.573	5.36404	230.883	186.427
226.409	5.34478	204.797	187.099
226.244	5.34478	186.133	187.099
226.08	5.33515	207.5	187.436
225.916	5.36404	201.008	186.427
225.752	5.33515	197.547	187.436
225.588	5.31589	182.602	188.115
225.424	5.287	207.133	189.143
225.26	5.34478	198.203	187.099
225.096	5.30626	209.75	188.457
224.932	5.34478	211.391	187.099
224.768	5.34478	188.578	187.099
224.604	5.49886	191.086	181.856
224.44	5.36404	171.961	186.427
224.276	5.49886	184.859	181.856
224.112	5.72035	211.602	174.814
223.948	6.05741	182.516	165.087
223.784	5.62405	193.188	177.808
223.62	5.44108	194.492	183.787
223.456	5.59516	206.352	178.726
223.292	5.4796	179.32	182.495
223.128	5.287	183.383	189.143
222.964	5.21958	215.664	191.586
222.8	5.287	198.977	189.143

222.636	5.33515	242.461	187.436
222.472	5.31589	214.836	188.115
222.307	5.24847	176.555	190.532
222.143	5.27737	183.875	189.488
221.979	5.23884	193.945	190.882
221.815	5.49886	207.242	181.856
221.651	5.33515	159.133	187.436
221.487	5.18106	185.266	193.011
221.323	5.24847	199.547	190.532
221.159	5.287	213.57	189.143
220.995	5.12328	217.305	195.187
220.831	5.20995	226.07	191.94
220.667	5.44108	210.609	183.787
220.503	5.41219	221.641	184.768
220.339	5.37367	190.211	186.093
220.175	5.33515	206.719	187.436
220.011	5.36404	187.297	186.427
219.847	5.3833	200.57	185.76
219.683	5.30626	196.305	188.457
219.519	5.21958	195.242	191.586
219.355	5.30626	173.211	188.457
219.191	5.12328	165.133	195.187
219.027	5.23884	139.477	190.882
218.863	5.41219	191.367	184.768
218.699	5.33515	231.008	187.436
218.535	5.19069	211.641	192.652
218.371	5.36404	204.734	186.427
218.206	5.19069	244.906	192.652
218.042	5.23884	201.086	190.882
217.878	5.12328	235.961	195.187
217.714	5.20995	219.125	191.94
217.55	5.15217	211.758	194.093
217.386	5.17143	214.453	193.37
217.222	5.31589	196.391	188.115
217.058	5.24847	177.773	190.532
216.894	5.24847	208.969	190.532
216.73	5.26774	191.008	189.835
216.566	5.0655	203.633	197.414
216.402	5.14254	203.477	194.456
216.238	5.08476	220.984	196.666
216.074	5.01735	218.789	199.308
215.91	5.01735	206.273	199.308
215.746	5.14254	166.367	194.456
215.582	5.19069	172.289	192.652
215.418	5.17143	185.266	193.37
215.254	5.33515	218.789	187.436
215.09	5.21958	209.898	191.586
214.926	5.0655	194.391	197.414
214.762	5.17143	211.125	193.37
214.598	4.99809	214.391	200.076
214.434	5.12328	193.867	195.187
214.27	5.20995	198.484	191.94
214.105	5.18106	220.602	193.011
213.941	5.05587	219.844	197.79
213.777	5.02698	174.461	198.927
213.613	5.23884	192.461	190.882
213.449	5.0655	183.344	197.414
213.285	5.09439	207.164	196.294
213.121	5.0655	186.492	197.414
212.957	4.86327	226.805	205.623
212.793	4.83438	211.539	206.852
212.629	4.85364	204.344	206.031
212.465	4.79586	166.18	208.513
212.301	5.11365	189.016	195.555
212.137	5.20995	176.633	191.94
211.973	5.21958	227.813	191.586
211.809	5.23884	197.648	190.882
211.645	4.86327	186.891	205.623

211.481	4.85364	225.609	206.031
211.317	4.85364	194.508	206.031
211.153	4.83438	212.188	206.852
210.989	4.94994	194.898	202.023
210.825	4.95957	185.82	201.63
210.661	4.93068	192.961	202.812
210.497	5.01735	198.844	199.308
210.333	4.98846	207.203	200.463
210.169	4.98846	220.078	200.463
210.004	4.99809	201.625	200.076
209.84	4.94994	189.82	202.023
209.676	4.95957	213.828	201.63
209.512	5.01735	191.898	199.308
209.348	4.90179	197.422	204.007
209.184	5.08476	177.789	196.666
209.02	5.08476	232.727	196.666
208.856	5.18106	175.078	193.011
208.692	5.12328	198.906	195.187
208.528	5.14254	219.313	194.456
208.364	4.89216	169.914	204.409
208.2	5.15217	174.508	194.093
208.036	5.11365	231.539	195.555
207.872	5.17143	187.617	193.37
207.708	5.15217	193.313	194.093
207.544	5.17143	175.625	193.37
207.38	5.23884	193.742	190.882
207.216	4.85364	189.766	206.031
207.052	5.17143	216.727	193.37
206.888	5.01735	212.711	199.308
206.724	5.26774	188.617	189.835
206.56	5.09439	197.836	196.294
206.396	5.17143	206.633	193.37
206.232	4.98846	217.797	200.463
206.067	4.90179	204.148	204.007
205.903	5.12328	208.453	195.187
205.739	5.0655	197.477	197.414
205.575	5.04624	208.328	198.167
205.411	5.23884	218.68	190.882
205.247	5.26774	204.039	189.835
205.083	5.31589	210.742	188.115
204.919	5.05587	225.438	197.79
204.755	5.21958	177.875	191.586
204.591	5.21958	183.422	191.586
204.427	5.18106	210.703	193.011
204.263	5.17143	228.148	193.37
204.099	5.26774	219.688	189.835
203.935	5.26774	207.391	189.835
203.771	5.33515	221.125	187.436
203.607	5.30626	219.234	188.457
203.443	5.27737	208.367	189.488
203.279	5.46034	195.914	183.139
203.115	5.34478	215.828	187.099
202.951	5.43145	225.172	184.113
202.787	5.43145	196.281	184.113
202.623	5.33515	240.695	187.436
202.459	5.31589	219.805	188.115
202.295	5.59516	201.5	178.726
202.131	5.78776	230.813	172.778
201.966	5.49886	220.922	181.856
201.802	5.52775	235.711	180.905
201.638	5.56627	229.5	179.654
201.474	5.6722	217.117	176.298
201.31	5.72998	214.484	174.521
201.146	5.69146	192.57	175.702
200.982	5.6722	195	176.298
200.818	5.82628	218.258	171.636
200.654	6.01889	201.133	166.144
200.49	5.74924	199.922	173.936

200.326	5.74924	225.508	173.936
200.162	5.96111	190.898	167.754
199.998	5.84554	189.266	171.07
199.834	5.75887	216.945	173.645
199.67	5.74924	206.039	173.936
199.506	5.63368	216.734	177.504
199.342	5.5759	181.641	179.343
199.178	5.7685	237.609	173.355
199.014	5.82628	205.227	171.636
198.85	5.69146	213.961	175.702
198.686	5.94185	187.07	168.298
198.522	5.96111	225.906	167.754
198.358	5.88406	224.492	169.951
198.194	5.79739	224.477	172.491
198.03	5.79739	175.219	172.491
197.865	5.81665	234.641	171.92
197.701	5.78776	231.813	172.778
197.537	5.79739	192.43	172.491
197.373	5.82628	177.523	171.636
197.209	5.88406	214.898	169.951
197.045	5.88406	227.297	169.951
196.881	5.88406	237.891	169.951
196.717	5.92259	237.727	168.845
196.553	5.91296	197.633	169.12
196.389	5.82628	239.805	171.636
196.225	5.81665	220.68	171.92
196.061	5.79739	226.727	172.491
195.897	5.94185	169.852	168.298
195.733	6.11519	179.453	163.527
195.569	6.1826	238.563	161.744
195.405	5.85517	186.93	170.789
195.241	6.24038	226.516	160.247
195.077	6.42335	234.961	155.682
194.913	6.20186	211.727	161.242
194.749	5.85517	237.078	170.789
194.585	6.00926	208.82	166.41
194.421	6.01889	180.641	166.144
194.257	5.8648	201.734	170.509
194.093	6.01889	214.5	166.144
193.929	5.91296	230.75	169.12
193.764	6.04778	235.117	165.35
193.6	6.05741	227.813	165.087
193.436	5.82628	229.719	171.636
193.272	6.04778	206.719	165.35
193.108	5.92259	241.414	168.845
192.944	5.92259	210.016	168.845
192.78	5.95148	182.563	168.026
192.616	5.91296	175.578	169.12
192.452	6.04778	200.594	165.35
192.288	5.88406	237.727	169.951
192.124	5.95148	223.984	168.026
191.96	5.91296	241.055	169.12
191.796	5.84554	195.234	171.07
191.632	5.84554	237.578	171.07
191.468	5.81665	217.75	171.92
191.304	5.91296	186.289	169.12
191.14	5.72998	195.914	174.521
190.976	5.95148	211.781	168.026
190.812	5.8648	216.727	170.509
190.648	5.8648	202.195	170.509
190.484	5.95148	222.063	168.026
190.32	5.70109	205.086	175.405
190.156	5.98037	248.93	167.214
189.992	5.75887	203.836	173.645
189.828	5.79739	236.953	172.491
189.663	5.82628	225.063	171.636
189.499	6.04778	186.906	165.35
189.335	6.0863	187.766	164.303

189.171	5.88406	219.016	169.951
189.007	5.99	194.922	166.945
188.843	5.8648	232.422	170.509
188.679	5.8648	202.641	170.509
188.515	5.72035	196.438	174.814
188.351	5.84554	183.273	171.07
188.187	5.89369	235.945	169.673
188.023	5.74924	222.766	173.936
187.859	5.72998	223.406	174.521
187.695	5.7685	206.109	173.355
187.531	5.78776	195.688	172.778
187.367	5.91296	226.234	169.12
187.203	5.82628	201.414	171.636
187.039	5.75887	237.813	173.645
186.875	5.85517	174.5	170.789
186.711	5.78776	183.906	172.778
186.547	6.01889	219.641	166.144
186.383	5.74924	213.203	173.936
186.219	5.78776	183.719	172.778
186.055	5.94185	252.5	168.298
185.891	5.82628	172.359	171.636
185.726	5.94185	180.844	168.298
185.562	5.99	180.336	166.945
185.398	5.99	218.625	166.945
185.234	5.81665	202.352	171.92
185.07	5.88406	194.055	169.951
184.906	5.89369	190.078	169.673
184.742	5.8648	184.969	170.509
184.578	5.98037	167.477	167.214
184.414	6.01889	149.898	166.144
184.25	5.92259	168.57	168.845
184.086	5.99	170.328	166.945
183.922	5.85517	163.305	170.789
183.758	6.04778	129.523	165.35
183.594	6.01889	147.328	166.144
183.43	5.95148	139.344	168.026
183.266	6.01889	143.914	166.144
183.102	6.25964	135.32	159.754
182.938	6.23075	136.648	160.494
182.774	6.55818	170.039	152.481
182.61	6.8856	139.344	145.231
182.446	7.04931	177.719	141.858
182.282	7.03968	168.484	142.052
182.118	7.2034	143.563	138.823
181.954	7.09746	153.25	140.895
181.79	7.13598	128.172	140.135
181.625	7.10709	164.523	140.704
181.461	7.04931	170.758	141.858
181.297	7.32859	154.102	136.452
181.133	7.31896	133.039	136.631
180.969	7.2034	155.375	138.823
180.805	7.45378	107.328	134.16
180.641	7.48267	142.539	133.642
180.477	7.396	137.453	135.208
180.313	7.63675	148.094	130.946
180.149	7.6849	159.352	130.125
179.985	7.44415	125.07	134.334
179.821	7.32859	146.523	136.452
179.657	7.44415	144.719	134.334
179.493	7.61749	177.711	131.277
179.329	7.45378	173.531	134.16
179.165	7.81009	137.117	128.039
179.001	8.06048	154.828	124.062
178.837	8.15678	146.906	122.597
178.673	8.32049	145.563	120.185
178.509	8.34938	174.016	119.769
178.345	8.1953	123.582	122.021
178.181	8.21456	136.531	121.735

178.017	7.9064	143.656	126.48
177.853	7.93529	164.188	126.019
177.689	7.94492	168.914	125.867
177.524	8.25308	148.867	121.167
177.36	8.50347	137.609	117.599
177.196	8.37827	136.711	119.356
177.032	8.63829	132.492	115.764
176.868	8.58051	155.195	116.543
176.704	8.47457	132.648	118
176.54	8.33975	110.637	119.908
176.376	8.37827	135.883	119.356
176.212	8.3879	149.203	119.219
176.048	8.1953	167.578	122.021
175.884	8.28197	135.883	120.744
175.72	8.2916	125.465	120.604
175.556	8.07011	158.852	123.914
175.392	8.24345	152.531	121.308
175.228	8.92719	143.688	112.017
175.064	8.91756	143.961	112.138
174.9	9.1198	151.984	109.652
174.736	9.24499	135.805	108.167
174.572	8.88867	170.156	112.503
174.408	8.5131	179.281	117.466
174.244	8.32049	168.484	120.185
174.08	8.47457	158.672	118
173.916	8.40716	154.172	118.946
173.752	7.93529	142.133	126.019
173.588	7.34785	165.281	136.094
173.423	6.26927	175.906	159.508
173.259	5.96111	151.328	167.754
173.095	5.55664	163.672	179.965
172.931	5.15217	145.305	194.093
172.767	4.99809	140.945	200.076
172.603	4.46843	138.984	223.792
172.439	4.05434	168.328	246.65
172.275	3.54394	145.32	282.172
172.111	3.67876	136.266	271.831
171.947	4.09286	140.539	244.328
171.783	4.79586	139.93	208.513
171.619	6.01889	125.801	166.144
171.455	6.55818	141.344	152.481
171.291	6.74115	142.953	148.343
171.127	6.0863	151.898	164.303
170.963	4.43954	161.32	225.248
170.799	3.03354	138.477	329.648
170.635	2.20535	183.906	453.443
170.471	0.375619	181.891	2662.27
170.307	-2.14748	188.359	-465.662
170.143	-2.78307	168.336	-359.315
169.979	-0.934082	197.836	-1070.57
169.815	1.73347	209.227	576.878
169.651	3.35134	247.266	298.389
169.486	5.33515	224.18	187.436
169.322	6.14408	222.766	162.758
169.158	6.29816	242.906	158.777
168.994	6.30779	214.391	158.534
168.83	5.91296	231.297	169.12
168.666	5.09439	221.273	196.294
168.502	4.69956	286.406	212.786
168.338	4.9692	250.445	201.24
168.174	5.89369	238.016	169.673
168.01	6.45224	264.328	154.985
167.846	8.79237	260.734	113.735
167.682	9.4087	238.648	106.285
167.518	9.20647	257.844	108.619
167.354	8.92719	204.844	112.017
167.19	8.92719	256.297	112.017
167.026	7.94492	253.805	125.867

166.862	6.9819	237.195	143.227
166.698	7.00116	248.734	142.833
166.534	7.70416	263.828	129.8
166.37	8.18567	222.914	122.165
166.206	8.28197	252.773	120.744
166.042	8.16641	248.773	122.453
165.878	7.93529	256.203	126.019
165.714	7.6849	246.328	130.125
165.55	7.52119	252.797	132.958
165.385	7.2997	242.016	136.992
165.221	7.03005	252.914	142.246
165.057	6.71226	260.594	148.981
164.893	6.5967	238.773	151.591
164.729	6.49076	218.828	154.065
164.565	6.0863	246.656	164.303
164.401	6.17297	261.453	161.997
164.237	5.99	251.406	166.945
164.073	6.17297	235.859	161.997
163.909	6.0863	244.664	164.303
163.745	6.17297	254.07	161.997
163.581	6.15371	244.828	162.504
163.417	5.95148	263.797	168.026
163.253	6.01889	291.391	166.144
163.089	5.7685	276.109	173.355
162.925	5.75887	264.859	173.645
162.761	5.95148	233.844	168.026
162.597	5.75887	271.578	173.645
162.433	5.59516	247.883	178.726
162.269	5.52775	257.281	180.905
162.105	5.5759	257.766	179.343
161.941	5.74924	282.547	173.936
161.777	5.75887	219.539	173.645
161.613	5.88406	267.313	169.951
161.449	5.85517	288.844	170.789
161.284	5.94185	296.547	168.298
161.12	5.70109	226.781	175.405
160.956	5.65294	252.531	176.899
160.792	5.53738	286.859	180.591
160.628	5.66257	255.156	176.598
160.464	5.88406	251.344	169.951
160.3	5.66257	225.273	176.598
160.136	6.10556	240.766	163.785
159.972	6.04778	253.539	165.35
159.808	5.89369	249.953	169.673
159.644	5.96111	242.18	167.754
159.48	5.94185	239.984	168.298
159.316	5.91296	220.883	169.12
159.152	5.84554	278.578	171.07
158.988	6.04778	316.703	165.35
158.824	6.15371	279.188	162.504
158.66	6.29816	284.734	158.777
158.496	6.33668	246.117	157.811
158.332	6.52928	269.5	153.156
158.168	6.49076	244.375	154.065
158.004	6.56781	241.547	152.258
157.84	6.46187	253.938	154.754
157.676	6.49076	282.484	154.065
157.512	7.00116	300.813	142.833
157.348	6.7893	244.789	147.291
157.183	7.04931	265.391	141.858
157.019	7.0782	323.453	141.279
156.855	7.29007	270.734	137.173
156.691	7.13598	287.344	140.135
156.527	7.00116	296.5	142.833
156.363	6.87597	235.422	145.434
156.199	7.00116	243.883	142.833
156.035	6.9819	296.656	143.227
155.871	6.91449	242.617	144.624

155.707	7.04931	242.398	141.858
155.543	6.95301	245.625	143.823
155.379	6.71226	278.156	148.981
155.215	6.83745	256.156	146.253
155.051	6.75078	230.57	148.131
154.887	6.56781	226.461	152.258
154.723	6.76041	233.641	147.92
154.559	6.55818	239.508	152.481
154.395	6.5967	246.586	151.591
154.231	6.693	258.609	149.41
154.067	6.65448	241.594	150.275
153.903	6.58707	249.953	151.813
153.739	6.51965	258.672	153.382
153.575	6.50039	217.875	153.837
153.411	6.58707	243.945	151.813
153.247	6.42335	290.813	155.682
153.082	6.45224	286.406	154.985
152.918	6.20186	255.445	161.242
152.754	6.11519	282.297	163.527
152.59	6.07667	260.422	164.564
152.426	6.17297	232.156	161.997
152.262	5.95148	262.313	168.026
152.098	6.00926	237.195	166.41
151.934	6.00926	250.367	166.41
151.77	6.04778	304.156	165.35
151.606	6.01889	253.648	166.144
151.442	5.88406	243.281	169.951
151.278	5.95148	302.969	168.026
151.114	5.85517	257.453	170.789
150.95	5.91296	238.719	169.12
150.786	5.92259	234.773	168.845
150.622	5.7685	272.875	173.355
150.458	5.78776	233.344	172.778
150.294	5.98037	241.313	167.214
150.13	5.8648	260.156	170.509
149.966	5.95148	242.648	168.026
149.802	5.92259	196.852	168.845
149.638	5.89369	219.875	169.673
149.474	5.95148	261.641	168.026
149.31	5.89369	266.984	169.673
149.145	5.74924	247.078	173.936
148.981	5.81665	262.031	171.92
148.817	5.99	225.125	166.945
148.653	5.92259	265.016	168.845
148.489	6.10556	238.039	163.785
148.325	5.96111	270.297	167.754
148.161	6.04778	276.172	165.35
147.997	6.10556	253.359	163.785
147.833	6.13445	263.734	163.014
147.669	6.13445	251.672	163.014
147.505	6.24038	257.609	160.247
147.341	6.21149	264.813	160.992
147.177	6.35594	270.453	157.333
147.013	6.36557	241.422	157.095
146.849	6.52928	250.195	153.156
146.685	6.54854	261.953	152.706
146.521	6.7893	255.367	147.291
146.357	6.61596	250.07	151.15
146.193	6.84708	261.016	146.048
146.029	6.95301	234.172	143.823
145.865	6.85671	219.039	145.843
145.701	6.9819	249.672	143.227
145.537	6.8856	238.531	145.231
145.373	6.87597	239.547	145.434
145.209	6.8856	249.969	145.231
145.044	7.00116	251.313	142.833
144.88	7.29007	202.258	137.173
144.716	7.26118	262.484	137.719

144.552	7.4923	226.961	133.47
144.388	7.46341	217.57	133.987
144.224	7.45378	203.516	134.16
144.06	7.36711	204.195	135.738
143.896	7.48267	208.734	133.642
143.732	7.70416	214.352	129.8
143.568	7.70416	217.703	129.8
143.404	7.9064	233.688	126.48
143.24	8.16641	251.469	122.453
143.076	8.22419	213.023	121.593
142.912	8.33975	227.563	119.908
142.748	8.28197	205.469	120.744
142.584	8.21456	256.375	121.735
142.42	8.06048	240.273	124.062
142.256	8.08937	232.586	123.619
142.092	8.24345	229.953	121.308
141.928	8.15678	282.453	122.597
141.764	8.2916	204.039	120.604
141.6	8.3879	260.234	119.219
141.436	8.25308	242.094	121.167
141.272	8.3879	233.656	119.219
141.108	8.33975	213.391	119.908
140.943	8.28197	224.5	120.744
140.779	8.03159	212.508	124.508
140.615	7.83899	229.406	127.568
140.451	7.94492	259.484	125.867
140.287	7.73305	233.875	129.315
140.123	7.75231	220.078	128.994
139.959	7.71379	216.414	129.638
139.795	7.7812	232.18	128.515
139.631	7.82935	209.883	127.724
139.467	7.74268	193.844	129.154
139.303	7.70416	219.719	129.8
139.139	7.84862	228.422	127.411
138.975	7.80046	218.336	128.197
138.811	8.08937	294.828	123.619
138.647	8.1953	248.148	122.021
138.483	8.32049	227.609	120.185
138.319	8.35901	305.406	119.631
138.155	8.58051	323.078	116.543
137.991	8.6094	299.469	116.152
137.827	8.91756	308.859	112.138
137.663	8.96571	248.109	111.536
137.499	9.02349	298.563	110.822
137.335	9.25462	305.563	108.054
137.171	9.62056	249.891	103.944
137.007	9.68797	283.875	103.221
136.842	9.53389	269.031	104.889
136.678	9.63982	278.656	103.736
136.514	9.63982	259.578	103.736
136.35	9.46648	257.75	105.636
136.186	9.37018	261.719	106.722
136.022	9.23536	284.719	108.28
135.858	9.01386	280.844	110.94
135.694	9.05238	228.57	110.468
135.53	8.88867	297.375	112.503
135.366	8.53236	284.922	117.201
135.202	8.40716	254.289	118.946
135.038	8.21456	258.156	121.735
134.874	7.9064	262.953	126.48
134.71	7.41526	263.844	134.857
134.546	6.87597	266.875	145.434
134.382	6.91449	229.695	144.624
134.218	6.61596	278.688	151.15
134.054	6.62559	246.039	150.93
133.89	6.55818	325.078	152.481
133.726	6.40409	261.063	156.15
133.562	6.26927	244.953	159.508

133.398	6.1826	280.984	161.744
133.234	6.1826	285.547	161.744
133.07	6.05741	264.703	165.087
132.906	5.94185	251.445	168.298
132.741	5.89369	290.141	169.673
132.577	5.79739	300.313	172.491
132.413	5.7685	254.859	173.355
132.249	5.70109	262.156	175.405
132.085	5.69146	264.813	175.702
131.921	5.66257	245.75	176.598
131.757	5.5759	264.344	179.343
131.593	5.46034	284.766	183.139
131.429	5.46997	275.875	182.816
131.265	5.52775	275.141	180.905
131.101	5.43145	275.453	184.113
130.937	5.21958	271.781	191.586
130.773	5.287	248.172	189.143
130.609	5.24847	301.578	190.532
130.445	5.15217	213.227	194.093
130.281	5.18106	300.578	193.011
130.117	5.17143	293.609	193.37
129.953	5.11365	265.953	195.555
129.789	5.01735	287.734	199.308
129.625	5.02698	269.063	198.927
129.461	5.14254	284.734	194.456
129.297	5.04624	235.547	198.167
129.133	4.90179	265.813	204.007
128.969	4.90179	280.859	204.007
128.804	4.92105	260.625	203.209
128.64	4.89216	244.672	204.409
128.476	4.95957	264.453	201.63
128.312	5.02698	310.781	198.927
128.148	4.94994	252.016	202.023
127.984	4.94994	275.188	202.023
127.82	4.82475	307.25	207.265
127.656	4.70919	289.875	212.351
127.492	4.89216	285.938	204.409
127.328	5.01735	286.719	199.308
127.164	4.83438	283.781	206.852
127	5.08476	229.867	196.666
126.836	4.98846	278.563	200.463
126.672	4.86327	277.672	205.623
126.508	4.86327	240.875	205.623
126.344	4.80549	262.094	208.095
126.18	4.92105	277.984	203.209
126.016	4.83438	281.594	206.852
125.852	4.99809	281.063	200.076
125.688	4.94994	277.891	202.023
125.524	4.89216	288.641	204.409
125.36	4.8729	262.219	205.217
125.196	4.8729	266.016	205.217
125.032	4.7766	265.688	209.354
124.868	4.83438	275.781	206.852
124.703	4.8729	267.656	205.217
124.539	4.90179	266.438	204.007
124.375	4.92105	260.906	203.209
124.211	4.93068	284.453	202.812
124.047	5.0655	260.734	197.414
123.883	4.80549	306.313	208.095
123.719	4.92105	284.016	203.209
123.555	4.89216	261.766	204.409
123.391	4.94994	256.016	202.023
123.227	5.02698	266.359	198.927
123.063	4.85364	295.25	206.031
122.899	4.82475	275.313	207.265
122.735	4.92105	325.359	203.209
122.571	4.89216	314.672	204.409
122.407	4.76697	260.906	209.777

122.243	4.92105	260.891	203.209
122.079	4.89216	267.438	204.409
121.915	4.89216	285.375	204.409
121.751	4.86327	298.313	205.623
121.587	4.76697	244.141	209.777
121.423	4.7766	336.078	209.354
121.259	4.89216	261.203	204.409
121.095	4.92105	223.148	203.209
120.931	4.95957	274.203	201.63
120.767	4.8729	276.406	205.217
120.602	4.93068	310.563	202.812
120.438	4.89216	296.078	204.409
120.274	4.80549	299.672	208.095
120.11	4.98846	255.445	200.463
119.946	4.85364	266.125	206.031
119.782	4.9692	274.281	201.24
119.618	5.09439	264.281	196.294
119.454	4.90179	301.328	204.007
119.29	4.93068	322.609	202.812
119.126	4.94994	274.906	202.023
118.962	4.94994	253.406	202.023
118.798	4.92105	313.984	203.209
118.634	4.7766	270.281	209.354
118.47	4.82475	276.672	207.265
118.306	4.8729	282.047	205.217
118.142	4.92105	319.625	203.209
117.978	4.90179	285.625	204.007
117.814	4.95957	264.594	201.63
117.65	4.89216	286.625	204.409
117.486	4.92105	311.094	203.209
117.322	4.89216	269.891	204.409
117.158	4.90179	289.016	204.007
116.994	4.79586	267.313	208.513
116.83	4.98846	293.656	200.463
116.666	4.92105	274.188	203.209
116.501	4.90179	310.781	204.007
116.337	4.82475	262.609	207.265
116.173	4.82475	290.766	207.265
116.009	4.95957	289.047	201.63
115.845	4.89216	314.375	204.409
115.681	4.83438	289.203	206.852
115.517	4.79586	240.125	208.513
115.353	4.7766	284.766	209.354
115.189	4.80549	283.234	208.095
115.025	4.82475	272.453	207.265
114.861	4.8729	253.906	205.217
114.697	4.85364	290.219	206.031
114.533	4.92105	275.281	203.209
114.369	4.92105	338.563	203.209
114.205	4.8729	279.75	205.217
114.041	4.8729	269.891	205.217
113.877	4.9692	286.219	201.24
113.713	4.98846	273.656	200.463
113.549	4.85364	288.172	206.031
113.385	4.70919	272.156	212.351
113.221	4.80549	283	208.095
113.057	4.86327	328.828	205.623
112.893	4.86327	269.406	205.623
112.729	4.94994	263.594	202.023
112.564	5.01735	282.922	199.308
112.4	4.94994	288.906	202.023
112.236	4.75734	295.906	210.202
112.072	4.83438	253.727	206.852
111.908	4.89216	244.594	204.409
111.744	4.82475	282.781	207.265
111.58	5.02698	288.031	198.927
111.416	4.8729	233.484	205.217
111.252	4.89216	240.461	204.409

111.088	4.92105	291.5	203.209
110.924	4.92105	274.266	203.209
110.76	5.08476	263.266	196.666
110.596	4.92105	310.391	203.209
110.432	4.90179	285.516	204.007
110.268	5.05587	298.406	197.79
110.104	5.11365	321.344	195.555
109.94	4.98846	257.406	200.463
109.776	4.46843	281.969	223.792
109.612	5.50849	301.828	181.538
109.448	5.52775	250.383	180.905
109.284	4.66104	300.078	214.545
109.12	6.04778	263.766	165.35
108.956	8.9946	273.969	111.178
108.792	6.2789	302.703	159.264
108.628	5.60479	246.672	178.419
108.463	6.01889	316.344	166.144
108.299	5.40256	288	185.098
108.135	1.50235	302.594	665.625
107.971	3.68839	303.125	271.121
107.807	5.40256	286.797	185.098
107.643	5.31589	283.453	188.115
107.479	5.15217	334.609	194.093
107.315	5.02698	304.125	198.927
107.151	4.98846	282.188	200.463
106.987	5.01735	276.438	199.308
106.823	4.94994	290.391	202.023
106.659	4.89216	270.781	204.409
106.495	4.98846	287.391	200.463
106.331	5.0655	256.656	197.414
106.167	4.89216	284.063	204.409
106.003	4.99809	255.781	200.076
105.839	4.92105	299.172	203.209
105.675	5.09439	239.891	196.294
105.511	5.11365	246.828	195.555
105.347	5.08476	265.453	196.666
105.183	4.98846	292.297	200.463
105.019	4.93068	286.234	202.812
104.855	5.0655	273.172	197.414
104.691	5.09439	327.047	196.294
104.527	5.02698	318.266	198.927
104.362	5.18106	262.375	193.011
104.198	5.09439	258.625	196.294
104.034	5.0655	304.125	197.414
103.87	5.09439	262.844	196.294
103.706	5.20995	269.188	191.94
103.542	5.17143	286.719	193.37
103.378	5.18106	311.219	193.011
103.214	5.11365	270	195.555
103.05	5.12328	299.75	195.187
102.886	5.17143	248.008	193.37
102.722	5.18106	251.023	193.011
102.558	5.08476	323.188	196.666
102.394	5.02698	300.188	198.927
102.23	5.11365	254.227	195.555
102.066	5.19069	270.672	192.652
101.902	5.14254	264.297	194.456
101.738	5.05587	290.797	197.79
101.574	5.02698	301.609	198.927
101.41	5.14254	251.422	194.456
101.246	5.23884	289.953	190.882
101.082	5.18106	306.313	193.011
100.918	5.0655	294.344	197.414
100.754	5.08476	300.156	196.666
100.59	5.19069	288.156	192.652
100.426	4.99809	237.211	200.076
100.261	5.26774	310.234	189.835
100.097	5.20995	263.141	191.94

99.9334	5.21958	286.031	191.586
99.7693	5.23884	251.68	190.882
99.6053	5.17143	305.234	193.37
99.4413	5.23884	291.938	190.882
99.2772	5.12328	256.391	195.187
99.1132	5.21958	265.969	191.586
98.9491	5.15217	301.281	194.093
98.7851	5.21958	278.391	191.586
98.6211	5.14254	255.641	194.456
98.457	5.17143	308.25	193.37
98.293	5.17143	254.5	193.37
98.1289	5.23884	253.984	190.882
97.9649	5.27737	288	189.488
97.8009	5.20995	286.906	191.94
97.6368	5.40256	295.313	185.098
97.4728	5.3833	277.828	185.76
97.3087	5.31589	307.719	188.115
97.1447	5.34478	267.984	187.099
96.9807	5.37367	270.047	186.093
96.8166	5.37367	278.359	186.093
96.6526	5.287	311.359	189.143
96.4885	5.41219	274.422	184.768
96.3245	5.34478	297.938	187.099
96.1605	5.60479	329.703	178.419
95.9964	5.43145	300.234	184.113
95.8324	5.5759	300.563	179.343
95.6683	5.4796	276.328	182.495
95.5043	5.52775	309.688	180.905
95.3403	5.5759	330.453	179.343
95.1762	5.56627	253.719	179.654
95.0122	5.5759	297.203	179.343
94.8481	5.60479	306.938	178.419
94.6841	5.7685	240.648	173.355
94.5201	5.75887	226.648	173.645
94.356	5.70109	303.141	175.405
94.192	5.72998	261.547	174.521
94.0279	5.91296	234.25	169.12
93.8639	5.78776	279.672	172.778
93.6999	5.94185	267.328	168.298
93.5358	5.99	297.125	166.945
93.3718	5.95148	269.703	168.026
93.2077	5.99	289.469	166.945
93.0437	6.11519	266.594	163.527
92.8796	6.23075	258.719	160.494
92.7156	6.30779	237.328	158.534
92.5516	6.32705	275.25	158.052
92.3875	6.24038	263.063	160.247
92.2235	6.3752	250.375	156.858
92.0595	6.33668	245.492	157.811
91.8954	6.56781	231.664	152.258
91.7314	6.65448	221.898	150.275
91.5673	6.68337	288.766	149.625
91.4033	6.84708	282.297	146.048
91.2392	7.01079	254.711	142.637
91.0752	7.23229	238.414	138.269
90.9112	7.36711	239.891	135.738
90.7471	7.46341	273.938	133.987
90.5831	7.74268	294.844	129.154
90.419	8.15678	251.078	122.597
90.255	8.32049	272.219	120.185
90.091	8.82126	241.18	113.362
89.9269	9.27388	240.023	107.83
89.7629	9.6013	274.891	104.153
89.5988	10.0154	244.305	99.8462
89.4348	10.4873	228.461	95.3536
89.2708	10.9014	252.773	91.7316
89.1067	11.1614	234.977	89.5946
88.9427	11.8644	193.547	84.2858

88.7786	12.837	173.047	77.8996
88.6146	14.166	142.477	70.5916
88.4506	15.7839	152.883	63.3559
88.2865	18.6536	142.539	53.6088
88.1225	21.6679	138.555	46.1513
87.9584	25.4718	147.102	39.2591
87.7944	30.518	142.586	32.7676
87.6304	37.4613	154.906	26.6942
87.4663	47.5152	132.758	21.0459
87.3023	62.6442	126.797	15.9632
87.1382	86.1995	107.406	11.601
86.9742	123.661	110.098	8.08664
86.8102	175.76	125.633	5.68958
86.6461	58.9077	73.9492	16.9757
86.4821	-234.523	73.8984	-4.26397
86.318	-234.523	79.9688	-4.26397
86.154	-234.523	107.992	-4.26397
85.99	-234.523	98.8242	-4.26397
85.8259	-234.523	101.809	-4.26397
85.6619	-234.523	86.6094	-4.26397
85.4978	-234.523	85.1836	-4.26397
85.3338	-234.523	97.8242	-4.26397
85.1698	-234.523	88.4219	-4.26397
85.0057	-234.523	82.2852	-4.26397
84.8417	-234.523	79.875	-4.26397
84.6776	-234.523	82.5547	-4.26397
84.5136	-234.523	82.0195	-4.26397
84.3496	-234.523	69.1563	-4.26397
84.1855	-234.523	98.4258	-4.26397
84.0215	-234.523	101.785	-4.26397
83.8574	-234.523	103.859	-4.26397
83.6934	-234.523	99.168	-4.26397
83.5293	-234.523	88.9219	-4.26397
83.3653	-234.523	101.527	-4.26397
83.2013	-234.523	86.168	-4.26397
83.0372	-234.523	107.281	-4.26397
82.8732	-234.523	82.3867	-4.26397
82.7092	-234.523	92.6094	-4.26397
82.5451	-234.523	70.6094	-4.26397
82.3811	-234.523	65.8711	-4.26397
82.217	-234.523	84.9258	-4.26397
82.053	-234.523	78.7188	-4.26397
81.8889	-234.523	69.1211	-4.26397
81.7249	-234.523	95.8984	-4.26397
81.5609	-234.523	68.9883	-4.26397
81.3968	-234.523	92.0664	-4.26397
81.2328	-234.523	121.668	-4.26397
81.0687	-234.523	88.3281	-4.26397
80.9047	-234.523	95.375	-4.26397
80.7407	-234.523	85.6914	-4.26397
80.5766	-234.523	115.402	-4.26397
80.4126	-234.523	86.5039	-4.26397
80.2485	-234.523	69.7461	-4.26397
80.0845	-234.523	72.5313	-4.26397
79.9205	-234.523	111.168	-4.26397
79.7564	-234.523	56.916	-4.26397
79.5924	-234.523	93.0547	-4.26397
79.4283	-234.523	73.8281	-4.26397
79.2643	-234.523	80.9375	-4.26397
79.1003	-234.523	78.7852	-4.26397
78.9362	-234.523	82.5977	-4.26397
78.7722	-234.523	82.7773	-4.26397
78.6081	-234.523	75.9297	-4.26397
78.4441	-234.523	88.6406	-4.26397
78.2801	-234.523	73.9844	-4.26397
78.116	-234.523	64.3008	-4.26397
77.952	-234.523	72.3203	-4.26397
77.7879	-234.523	65.9102	-4.26397

77.6239	-234.523	70.8086	-4.26397
77.4599	-234.523	60.9316	-4.26397
77.2958	-234.523	52.873	-4.26397
77.1318	-234.523	51.4902	-4.26397
76.9677	-234.523	63.9629	-4.26397
76.8037	-234.523	77.207	-4.26397
76.6397	-234.523	46.3164	-4.26397
76.4756	-234.523	62.4453	-4.26397
76.3116	-234.523	54.4355	-4.26397
76.1475	-234.523	57.9746	-4.26397
75.9835	-234.523	60.0449	-4.26397
75.8195	-234.523	52.4004	-4.26397
75.6554	-234.523	55.2988	-4.26397
75.4914	-234.523	43.8242	-4.26397
75.3273	-234.523	44.3164	-4.26397
75.1633	-234.523	51.5625	-4.26397
74.9993	-234.523	63.1797	-4.26397
74.8352	-234.523	49.375	-4.26397
74.6712	-234.523	22.9707	-4.26397
74.5071	-234.523	49.1797	-4.26397
74.3431	-234.523	54.3438	-4.26397
74.1791	-234.523	55.709	-4.26397
74.015	-234.523	61.6836	-4.26397
73.851	-234.523	52.1602	-4.26397
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73.5229	-234.523	38.959	-4.26397
73.3588	-234.523	67.6094	-4.26397
73.1948	-234.523	68.8086	-4.26397
73.0308	-234.523	54.4297	-4.26397
72.8667	-234.523	67.1563	-4.26397
72.7027	-234.523	39.9473	-4.26397
72.5386	-234.523	35.5488	-4.26397
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72.2106	-234.523	53.4355	-4.26397
72.0465	-234.523	47.4922	-4.26397
71.8825	-234.523	41.5039	-4.26397
71.7184	-234.523	45.2148	-4.26397
71.5544	-234.523	30.7754	-4.26397
71.3904	-234.523	51.8145	-4.26397
71.2263	-234.523	51.8809	-4.26397
71.0623	-234.523	39.0156	-4.26397
70.8982	-234.523	35.6367	-4.26397
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69.914	-234.523	57.7031	-4.26397
69.75	-234.523	42.8242	-4.26397
69.5859	-234.523	52.3457	-4.26397
69.4219	-234.523	51.791	-4.26397
69.2578	-234.523	52.0293	-4.26397
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68.9298	-234.523	47.8105	-4.26397
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68.6017	-234.523	30.2598	-4.26397
68.4376	-234.523	40.8535	-4.26397
68.2736	-234.523	42.3633	-4.26397
68.1096	-234.523	27.8359	-4.26397
67.9455	-234.523	34.1074	-4.26397
67.7815	-234.523	42.4688	-4.26397
67.6174	-234.523	38.4863	-4.26397
67.4534	-234.523	49.6016	-4.26397
67.2894	-234.523	41.4531	-4.26397
67.1253	-234.523	27.127	-4.26397
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66.7972	-234.523	58.5645	-4.26397
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66.4692	-234.523	49.9082	-4.26397
66.3051	-234.523	34.6875	-4.26397
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65.977	-234.523	50.9258	-4.26397
65.813	-234.523	47.0527	-4.26397
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65.4849	-234.523	43.3555	-4.26397
65.3209	-234.523	56.9082	-4.26397
65.1568	-234.523	59.9336	-4.26397
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64.8288	-234.523	58.4688	-4.26397
64.6647	-234.523	44.7813	-4.26397
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64.3366	-234.523	42.5977	-4.26397
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63.8445	-234.523	43.0039	-4.26397
63.6805	-234.523	52.582	-4.26397
63.5164	-234.523	44.3535	-4.26397
63.3524	-234.523	73.0352	-4.26397
63.1883	-234.523	49.7129	-4.26397
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62.3681	-234.523	53.5039	-4.26397
62.2041	-234.523	62.2617	-4.26397
62.0401	-234.523	68.8203	-4.26397
61.876	-234.523	69.6836	-4.26397
61.712	-234.523	48.4141	-4.26397
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61.3839	-234.523	38.0039	-4.26397
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59.4154	-234.523	61.959	-4.26397
59.2514	-234.523	69.8945	-4.26397
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57.4469	-234.523	62.1738	-4.26397
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55.6425	-234.523	68.5508	-4.26397
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55.1504	-234.523	64.9688	-4.26397
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54.8223	-234.523	60.1914	-4.26397
54.6582	-234.523	67.7617	-4.26397
54.4942	-234.523	67.6563	-4.26397
54.3302	-234.523	68.1914	-4.26397
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53.51	-234.523	67.4453	-4.26397
53.3459	-234.523	51.2949	-4.26397
53.1819	-234.523	50.9785	-4.26397
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47.1124	-234.523	52.1523	-4.26397
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46.2922	-234.523	40.0137	-4.26397
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41.371	-234.523	55.4629	-4.26397
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37.434	-234.523	47.1348	-4.26397
37.27	-234.523	52.166	-4.26397
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33.497	-234.523	44.5898	-4.26397
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32.6768	-234.523	52.1016	-4.26397
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32.3488	-234.523	51.8086	-4.26397
32.1847	-234.523	48.4805	-4.26397
32.0207	-234.523	48.9922	-4.26397
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31.2005	-234.523	42.5801	-4.26397
31.0364	-234.523	37.5918	-4.26397
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30.7084	-234.523	53.7871	-4.26397
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30.2162	-234.523	19.7109	-4.26397
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29.8882	-234.523	39.1777	-4.26397
29.7241	-234.523	46.0566	-4.26397
29.5601	-234.523	45.2129	-4.26397
29.396	-234.523	37.1699	-4.26397
29.232	-234.523	41.9043	-4.26397
29.068	-234.523	33.2324	-4.26397
28.9039	-234.523	47.793	-4.26397
28.7399	-234.523	54.3535	-4.26397
28.5758	-234.523	53.1191	-4.26397
28.4118	-234.523	34.7344	-4.26397
28.2477	-234.523	47.3887	-4.26397
28.0837	-234.523	41.8398	-4.26397
27.9197	-234.523	43.5664	-4.26397
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27.4275	-234.523	61.9922	-4.26397
27.2635	-234.523	47.084	-4.26397
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23.8187	-234.523	34.7539	-4.26397
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23.4906	-234.523	27.3506	-4.26397
23.3265	-234.523	27.4463	-4.26397
23.1625	-234.523	29.2725	-4.26397
22.9985	-234.523	49	-4.26397
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22.0142	-234.523	45.4766	-4.26397

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21.3581	-234.523	36.1035	-4.26397
21.194	-234.523	44.2656	-4.26397
21.03	-234.523	45.8164	-4.26397
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20.7019	-234.523	27.8457	-4.26397
20.5379	-234.523	41.2695	-4.26397
20.3738	-234.523	39.918	-4.26397
20.2098	-234.523	41.8066	-4.26397
20.0457	-234.523	38.6074	-4.26397
19.8817	-234.523	63.418	-4.26397
19.7177	-234.523	53.5234	-4.26397
19.5536	-234.523	40.125	-4.26397
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19.2255	-234.523	46.0645	-4.26397
19.0615	-234.523	50.5293	-4.26397
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18.2413	-234.523	53.4375	-4.26397
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17.9132	-234.523	48.7402	-4.26397
17.7492	-234.523	56.9395	-4.26397
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17.4211	-234.523	48.5137	-4.26397
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17.257	-234.523	35.7949	-4.26397
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17.5851	-234.523	59.6953	-4.26397
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17.9132	-234.523	23.9307	-4.26397
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19.0615	-234.523	23.9355	-4.26397
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23.8187	-234.523	47.7578	-4.26397
23.9827	-234.523	35.8184	-4.26397
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24.4748	-234.523	23.8633	-4.26397
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26.4433	-234.523	11.9604	-4.26397
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28.5758	-234.523	47.7383	-4.26397
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30.7084	-234.523	47.8418	-4.26397
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31.0364	-234.523	11.9678	-4.26397
31.2005	-234.523	35.8906	-4.26397
31.3645	-234.523	23.9355	-4.26397
31.5286	-999.25	-999.25	-999.25
31.6926	-234.523	83.7148	-4.26397
31.8566	-234.523	35.791	-4.26397
32.0207	-234.523	11.9419	-4.26397
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32.3488	-234.523	59.6816	-4.26397
32.5128	-234.523	11.9409	-4.26397
32.6768	-999.25	-999.25	-999.25
32.8409	-234.523	47.7266	-4.26397
33.0049	-234.523	35.8047	-4.26397
33.169	-234.523	47.752	-4.26397
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33.497	-234.523	47.7637	-4.26397
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33.8251	-234.523	83.5352	-4.26397
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35.7936	-234.523	35.873	-4.26397
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36.2857	-234.523	23.873	-4.26397
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36.6138	-234.523	47.752	-4.26397
36.7778	-999.25	-999.25	-999.25
36.9419	-234.523	11.9316	-4.26397
37.1059	-234.523	47.7324	-4.26397
37.27	-234.523	23.873	-4.26397
37.434	-234.523	71.5625	-4.26397
37.598	-234.523	47.8672	-4.26397
37.7621	-999.25	-999.25	-999.25
37.9261	-234.523	35.877	-4.26397
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38.2542	-234.523	23.9307	-4.26397
38.4183	-234.523	107.715	-4.26397
38.5823	-234.523	83.7578	-4.26397
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38.9104	-234.523	47.8418	-4.26397
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39.2385	-234.523	23.9307	-4.26397
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39.8946	-234.523	35.877	-4.26397
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40.7148	-234.523	47.752	-4.26397
40.8789	-999.25	-999.25	-999.25
41.0429	-234.523	47.7383	-4.26397
41.2069	-234.523	47.7324	-4.26397
41.371	-234.523	83.5664	-4.26397
41.535	-234.523	95.7344	-4.26397
41.6991	-234.523	23.9336	-4.26397
41.8631	-999.25	-999.25	-999.25
42.0271	-234.523	83.7148	-4.26397
42.1912	-234.523	47.8301	-4.26397
42.3552	-234.523	59.8496	-4.26397
42.5193	-234.523	35.8945	-4.26397
42.6833	-234.523	23.9336	-4.26397
42.8473	-999.25	-999.25	-999.25
43.0114	-234.523	59.8027	-4.26397
43.1754	-234.523	35.8809	-4.26397
43.3395	-234.523	59.8281	-4.26397
43.5035	-234.523	71.8086	-4.26397
43.6675	-234.523	35.9004	-4.26397
43.8316	-999.25	-999.25	-999.25
43.9956	-234.523	59.6426	-4.26397
44.1597	-234.523	35.8047	-4.26397
44.3237	-234.523	23.8789	-4.26397
44.4877	-234.523	107.441	-4.26397
44.6518	-234.523	35.8223	-4.26397
44.8158	-234.523	71.6445	-4.26397
44.9799	-999.25	-999.25	-999.25
45.1439	-234.523	95.4531	-4.26397
45.3079	-234.523	71.5898	-4.26397
45.472	-234.523	47.8672	-4.26397
45.636	-234.523	47.8672	-4.26397
45.8001	-234.523	47.8672	-4.26397
45.9641	-999.25	-999.25	-999.25
46.1282	-234.523	23.9209	-4.26397
46.2922	-234.523	47.8359	-4.26397
46.4562	-234.523	47.8672	-4.26397
46.6203	-234.523	47.8613	-4.26397
46.7843	-234.523	71.8008	-4.26397
46.9484	-234.523	35.9043	-4.26397
47.1124	-999.25	-999.25	-999.25
47.2764	-234.523	83.7227	-4.26397
47.4405	-234.523	23.918	-4.26397
47.6045	-234.523	35.8945	-4.26397
47.7686	-234.523	71.625	-4.26397
47.9326	-999.25	-999.25	-999.25
48.0966	-234.523	11.9316	-4.26397
48.2607	-234.523	59.666	-4.26397
48.4247	-234.523	23.8818	-4.26397
48.5888	-234.523	47.752	-4.26397
48.7528	-234.523	47.7578	-4.26397
48.9168	-234.523	47.7637	-4.26397
49.0809	-999.25	-999.25	-999.25
49.2449	-234.523	47.7207	-4.26397

49.409	-234.523	59.6738	-4.26397
49.573	-234.523	59.6953	-4.26397
49.737	-234.523	47.8613	-4.26397
49.9011	-234.523	71.8008	-4.26397
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50.2292	-234.523	71.7734	-4.26397
50.3932	-234.523	47.8301	-4.26397
50.5572	-234.523	23.9355	-4.26397
50.7213	-234.523	35.8945	-4.26397
50.8853	-234.523	23.9336	-4.26397
51.0494	-234.523	23.9404	-4.26397
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51.3774	-234.523	47.8301	-4.26397
51.5415	-234.523	59.6523	-4.26397
51.7055	-234.523	11.9395	-4.26397
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52.6898	-234.523	83.5664	-4.26397
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53.3459	-234.523	11.9316	-4.26397
53.51	-234.523	107.41	-4.26397
53.674	-234.523	23.876	-4.26397
53.838	-234.523	59.6953	-4.26397
54.0021	-234.523	59.6953	-4.26397
54.1661	-999.25	-999.25	-999.25
54.3302	-234.523	59.7891	-4.26397
54.4942	-234.523	23.9209	-4.26397
54.6582	-234.523	59.834	-4.26397
54.8223	-234.523	35.8945	-4.26397
54.9863	-234.523	59.8418	-4.26397
55.1504	-999.25	-999.25	-999.25
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55.4785	-234.523	59.7969	-4.26397
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55.9706	-234.523	119.684	-4.26397
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56.2986	-234.523	47.7266	-4.26397
56.4627	-234.523	47.7324	-4.26397
56.6267	-234.523	71.625	-4.26397
56.7908	-234.523	59.6914	-4.26397
56.9548	-234.523	83.5	-4.26397
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57.2829	-234.523	47.7207	-4.26397
57.4469	-234.523	35.8008	-4.26397
57.611	-234.523	47.7578	-4.26397
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57.9391	-234.523	23.8545	-4.26397
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58.2671	-234.523	35.8008	-4.26397
58.4312	-234.523	59.6523	-4.26397
58.5952	-234.523	35.7813	-4.26397
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58.9233	-234.523	83.6914	-4.26397
59.0873	-234.523	95.7344	-4.26397
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59.4154	-234.523	95.6602	-4.26397
59.5795	-234.523	95.6992	-4.26397
59.7435	-234.523	59.8281	-4.26397
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61.0558	-234.523	35.9004	-4.26397
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61.3839	-234.523	23.8604	-4.26397
61.5479	-234.523	47.7383	-4.26397
61.712	-234.523	83.5664	-4.26397
61.876	-234.523	23.873	-4.26397
62.0401	-234.523	47.709	-4.26397
62.2041	-999.25	-999.25	-999.25
62.3681	-234.523	47.8418	-4.26397
62.5322	-234.523	35.7949	-4.26397
62.6962	-234.523	95.5156	-4.26397
62.8603	-234.523	59.6914	-4.26397
63.0243	-234.523	47.7676	-4.26397
63.1883	-999.25	-999.25	-999.25
63.3524	-234.523	23.8633	-4.26397
63.5164	-234.523	59.6523	-4.26397
63.6805	-234.523	47.7637	-4.26397
63.8445	-234.523	35.8125	-4.26397
64.0085	-234.523	47.7578	-4.26397
64.1726	-999.25	-999.25	-999.25
64.3366	-234.523	95.4766	-4.26397
64.5007	-234.523	47.8359	-4.26397
64.6647	-234.523	59.8281	-4.26397
64.8288	-234.523	47.8711	-4.26397
64.9928	-234.523	59.834	-4.26397
65.1568	-999.25	-999.25	-999.25
65.3209	-234.523	71.7617	-4.26397
65.4849	-234.523	35.877	-4.26397
65.6489	-234.523	11.9668	-4.26397
65.813	-234.523	11.9639	-4.26397
65.977	-234.523	23.9121	-4.26397
66.1411	-999.25	-999.25	-999.25
66.3051	-234.523	35.877	-4.26397
66.4692	-234.523	59.7891	-4.26397
66.6332	-234.523	35.8691	-4.26397
66.7972	-234.523	35.9004	-4.26397
66.9613	-234.523	0	-4.26397
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67.2894	-234.523	59.7891	-4.26397
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67.6174	-234.523	11.9653	-4.26397
67.7815	-234.523	47.752	-4.26397
67.9455	-234.523	95.5352	-4.26397
68.1096	-999.25	-999.25	-999.25
68.2736	-234.523	83.5117	-4.26397
68.4376	-234.523	47.7207	-4.26397
68.6017	-234.523	23.8574	-4.26397
68.7657	-234.523	71.6367	-4.26397
68.9298	-234.523	11.9409	-4.26397
69.0938	-234.523	83.5742	-4.26397
69.2578	-999.25	-999.25	-999.25
69.4219	-234.523	35.877	-4.26397
69.5859	-234.523	47.8418	-4.26397
69.75	-234.523	35.9004	-4.26397
69.914	-234.523	83.7461	-4.26397
70.078	-234.523	35.9004	-4.26397
70.2421	-999.25	-999.25	-999.25
70.4061	-234.523	23.9209	-4.26397
70.5702	-234.523	23.915	-4.26397
70.7342	-234.523	35.8633	-4.26397
70.8982	-234.523	59.8281	-4.26397
71.0623	-999.25	-999.25	-999.25
71.2263	-234.523	35.8457	-4.26397
71.3904	-234.523	35.873	-4.26397
71.5544	-234.523	71.7188	-4.26397

71.7184	-234.523	47.8809	-4.26397
71.8825	-234.523	59.8281	-4.26397
72.0465	-999.25	-999.25	-999.25
72.2106	-234.523	23.9248	-4.26397
72.3746	-234.523	35.877	-4.26397
72.5386	-234.523	35.8125	-4.26397
72.7027	-234.523	47.7578	-4.26397
72.8667	-234.523	83.5742	-4.26397
73.0308	-234.523	47.752	-4.26397
73.1948	-999.25	-999.25	-999.25
73.3588	-234.523	59.6738	-4.26397
73.5229	-234.523	23.8574	-4.26397
73.6869	-234.523	47.709	-4.26397
73.851	-234.523	59.6953	-4.26397
74.015	-234.523	23.8789	-4.26397
74.1791	-999.25	-999.25	-999.25
74.3431	-234.523	59.666	-4.26397
74.5071	-234.523	71.5898	-4.26397
74.6712	-234.523	23.873	-4.26397
74.8352	-234.523	47.7012	-4.26397
74.9993	-999.25	-999.25	-999.25
75.1633	-234.523	59.5977	-4.26397
75.3273	-234.523	23.8633	-4.26397
75.4914	-234.523	59.6953	-4.26397
75.6554	-234.523	23.876	-4.26397
75.8195	-999.25	-999.25	-999.25
75.9835	-234.523	59.5977	-4.26397
76.1475	-234.523	83.5469	-4.26397
76.3116	-234.523	59.6816	-4.26397
76.4756	-234.523	23.8506	-4.26397
76.6397	-234.523	83.5664	-4.26397
76.8037	-234.523	11.9546	-4.26397
76.9677	-999.25	-999.25	-999.25
77.1318	-234.523	71.7617	-4.26397
77.2958	-234.523	95.6602	-4.26397
77.4599	-234.523	59.8418	-4.26397
77.6239	-234.523	47.8613	-4.26397
77.7879	-234.523	35.9004	-4.26397
77.952	-234.523	47.8672	-4.26397
78.116	-999.25	-999.25	-999.25
78.2801	-234.523	47.7266	-4.26397
78.4441	-234.523	59.6523	-4.26397
78.6081	-234.523	95.5039	-4.26397
78.7722	-234.523	107.355	-4.26397
78.9362	-234.523	71.625	-4.26397
79.1003	-999.25	-999.25	-999.25
79.2643	-234.523	83.5352	-4.26397
79.4283	-234.523	107.402	-4.26397
79.5924	-234.523	107.43	-4.26397
79.7564	-234.523	35.7813	-4.26397
79.9205	-234.523	47.7637	-4.26397
80.0845	-999.25	-999.25	-999.25
80.2485	-234.523	59.6523	-4.26397
80.4126	-234.523	35.8008	-4.26397
80.5766	-234.523	107.441	-4.26397
80.7407	-234.523	119.551	-4.26397
80.9047	-234.523	119.668	-4.26397
81.0687	-234.523	71.7891	-4.26397
81.2328	-999.25	-999.25	-999.25
81.3968	-234.523	71.7617	-4.26397
81.5609	-234.523	167.445	-4.26397
81.7249	-234.523	83.5547	-4.26397
81.8889	-234.523	71.582	-4.26397
82.053	-234.523	35.8184	-4.26397
82.217	-234.523	119.383	-4.26397
82.3811	-999.25	-999.25	-999.25
82.5451	-234.523	131.25	-4.26397
82.7092	-234.523	95.6836	-4.26397

82.8732	-234.523	95.7227	-4.26397
83.0372	-234.523	59.7051	-4.26397
83.2013	-234.523	107.457	-4.26397
83.3653	-234.523	107.703	-4.26397
83.5293	-234.523	59.8281	-4.26397
83.6934	-234.523	179.5	-4.26397
83.8574	-234.523	95.5039	-4.26397
84.0215	-234.523	47.7637	-4.26397
84.1855	-234.523	59.834	-4.26397
84.3496	-999.25	-999.25	-999.25
84.5136	-234.523	35.873	-4.26397
84.6776	-234.523	107.645	-4.26397
84.8417	-234.523	131.336	-4.26397
85.0057	-234.523	71.625	-4.26397
85.1698	-234.523	59.6953	-4.26397
85.3338	-234.523	95.7422	-4.26397
85.4978	-234.523	107.684	-4.26397
85.6619	-234.523	47.7637	-4.26397
85.8259	-234.523	107.441	-4.26397
85.99	-234.523	47.7578	-4.26397
86.154	-999.25	-999.25	-999.25
86.318	-234.523	179.414	-4.26397
86.4821	-234.523	143.492	-4.26397
86.6461	-234.523	83.5664	-4.26397
86.8102	-234.293	83.4922	-4.26815
86.9742	251.973	119.656	3.96868
87.1382	155.286	179.523	6.43972
87.3023	112.124	215.406	8.91871
87.4663	79.391	119.668	12.5959
87.6304	-999.25	-999.25	-999.25
87.7944	57.7809	167.43	17.3067
87.9584	43.2972	179.414	23.0962
88.1225	33.3011	143.602	30.029
88.2865	26.6178	167.539	37.5689
88.4506	21.7353	119.656	46.0081
88.6146	-999.25	-999.25	-999.25
88.7786	18.3936	107.637	54.3666
88.9427	16.0728	227.227	62.2171
89.1067	14.3971	227.375	69.4583
89.2708	13.28	251.336	75.3011
89.4348	-999.25	-999.25	-999.25
89.5988	12.1629	191.344	82.2171
89.7629	11.2384	263.094	88.9804
89.9269	10.9399	263.266	91.4086
90.091	10.3717	358.188	96.4161
90.255	9.65908	358.141	103.529
90.419	-999.25	-999.25	-999.25
90.5831	9.05238	286.063	110.468
90.7471	8.86941	250.602	112.747
90.9112	8.73459	262.625	114.487
91.0752	8.37827	298.563	119.356
91.2392	8.02196	202.922	124.658
91.4033	7.80046	262.359	128.197
91.5673	-999.25	-999.25	-999.25
91.7314	7.57897	143.383	131.944
91.8954	7.2997	251.109	136.992
92.0595	7.29007	371.016	137.173
92.2235	7.25155	335.078	137.902
92.3875	7.25155	287.203	137.902
92.5516	-999.25	-999.25	-999.25
92.7156	7.06857	155.453	141.471
92.8796	6.93375	215.313	144.222
93.0437	6.55818	263.266	152.481
93.2077	6.76041	155.547	147.92
93.3718	6.5967	263.297	151.591
93.5358	-999.25	-999.25	-999.25
93.6999	6.40409	263.094	156.15
93.8639	6.40409	191.344	156.15

94.0279	6.15371	359.109	162.504
94.192	6.07667	323.063	164.564
94.356	6.10556	323.109	163.785
94.5201	-999.25	-999.25	-999.25
94.6841	5.85517	226.703	170.789
94.8481	5.66257	346.078	176.598
95.0122	5.7685	334.297	173.355
95.1762	5.81665	298.516	171.92
95.3403	5.74924	262.625	173.936
95.5043	-999.25	-999.25	-999.25
95.6683	5.85517	417.625	170.789
95.8324	5.66257	346.078	176.598
95.9964	5.55664	334.297	179.965
96.1605	5.8648	263.266	170.509
96.3245	5.84554	287.156	171.07
96.4885	5.7685	250.734	173.355
96.6526	5.74924	310.391	173.936
96.8166	5.85517	274.953	170.789
96.9807	5.5759	262.703	179.343
97.1447	5.72035	214.859	174.814
97.3087	5.62405	251.047	177.808
97.4728	5.53738	338.438	180.591
97.6368	5.81665	295.984	171.92
97.8009	5.55664	308.25	179.965
97.9649	5.6722	241.32	176.298
98.1289	5.69146	245.133	175.702
98.293	5.46034	257.109	183.139
98.457	5.43145	273.375	184.113
98.6211	5.50849	398.891	181.538
98.7851	5.40256	244.82	185.098
98.9491	5.30626	246.867	188.457
99.1132	5.4796	312.266	182.495
99.2772	5.37367	339.516	186.093
99.4413	5.46997	287.328	182.816
99.6053	5.36404	269.094	186.427
99.7693	5.19069	237.328	192.652
99.9334	5.24847	332.609	190.532
100.097	5.30626	224.859	188.457
100.261	5.37367	265.813	186.093
100.426	5.20995	246.43	191.94
100.59	5.30626	274.156	188.457
100.754	5.05587	292.563	197.79
100.918	5.05587	297.859	197.79
101.082	4.85364	301.859	206.031
101.246	4.95957	273.844	201.63
101.41	4.99809	280.156	200.076
101.574	4.80549	276.25	208.095
101.738	4.76697	299.266	209.777
101.902	4.82475	281.188	207.265
102.066	4.89216	274.938	204.409
102.23	4.94994	261.844	202.023
102.394	4.83438	271.594	206.852
102.558	5.02698	286.406	198.927
102.722	4.95957	260.188	201.63
102.886	4.73808	273.578	211.056
103.05	4.7766	289.625	209.354
103.214	4.99809	273.609	200.076
103.378	4.75734	265.453	210.202
103.542	4.90179	286.672	204.007
103.706	4.83438	305.391	206.852
103.87	4.85364	280.281	206.031
104.034	4.83438	264.219	206.852
104.198	4.73808	281.625	211.056
104.362	4.83438	263.625	206.852
104.527	4.82475	276.266	207.265
104.691	4.64178	250.242	215.435
104.855	4.66104	328.328	214.545
105.019	4.58399	305.375	218.15

105.183	4.64178	283.031	215.435
105.347	4.6803	276.031	213.662
105.511	4.66104	299.844	214.545
105.675	4.70919	286.016	212.351
105.839	4.70919	314.063	212.351
106.003	4.56473	275.469	219.071
106.167	4.53584	291.766	220.466
106.331	4.64178	258.5	215.435
106.495	4.51658	268.656	221.406
106.659	4.60325	290.031	217.238
106.823	4.46843	268.391	223.792
106.987	4.50695	270.922	221.879
107.151	4.46843	351.734	223.792
107.315	4.46843	278.953	223.792
107.479	4.48769	301.594	222.832
107.643	4.64178	271.531	215.435
107.807	4.63215	296.688	215.883
107.971	4.7766	263.844	209.354
108.135	4.66104	261.063	214.545
108.299	-0.85704	282.719	-1166.81
108.463	3.92914	289.406	254.508
108.628	6.90486	279.188	144.826
108.792	5.52775	287.75	180.905
108.956	5.08476	330.641	196.666
109.12	5.95148	255.438	168.026
109.284	6.94338	295.172	144.022
109.448	4.21805	288.188	237.076
109.612	4.22768	281.688	236.536
109.776	5.41219	313.422	184.768
109.94	4.48769	313.844	222.832
110.104	4.09286	266.781	244.328
110.268	4.48769	293.516	222.832
110.432	4.54547	265.266	219.999
110.596	4.44917	280.891	224.761
110.76	4.22768	262.625	236.536
110.924	4.25657	220.969	234.931
111.088	4.29509	277.344	232.824
111.252	4.39139	258.188	227.718
111.416	4.34324	258.781	230.243
111.58	4.38176	307.219	228.219
111.744	4.25657	244.891	234.931
111.908	4.09286	280.422	244.328
112.072	4.24694	298.422	235.464
112.236	4.35287	278.953	229.733
112.4	4.35287	289.797	229.733
112.564	4.42028	237.133	226.23
112.729	4.25657	290.688	234.931
112.893	4.29509	244.641	232.824
113.057	4.39139	284.984	227.718
113.221	4.29509	259.25	232.824
113.385	4.24694	254.547	235.464
113.549	4.22768	244.648	236.536
113.713	4.22768	275.625	236.536
113.877	4.17953	309.531	239.261
114.041	4.35287	282.219	229.733
114.205	4.18916	326.531	238.711
114.369	4.32398	285.75	231.268
114.533	4.38176	272	228.219
114.697	4.39139	280.922	227.718
114.861	4.28546	258.078	233.347
115.025	4.39139	266.672	227.718
115.189	4.34324	300.125	230.243
115.353	4.35287	267.063	229.733
115.517	4.24694	285.75	235.464
115.681	4.19879	309.797	238.164
115.845	4.09286	258.672	244.328
116.009	4.17953	294.5	239.261
116.173	4.31435	250.352	231.785

116.337	4.13138	248.109	242.05
116.501	4.09286	306.078	244.328
116.666	4.17953	270.375	239.261
116.83	4.28546	317	233.347
116.994	4.21805	271.297	237.076
117.158	4.18916	299.641	238.711
117.322	4.27583	271.156	233.873
117.486	4.19879	265.469	238.164
117.65	4.21805	314.125	237.076
117.814	4.25657	320.828	234.931
117.978	4.06397	289.859	246.065
118.142	4.18916	280.5	238.711
118.306	4.18916	289.469	238.711
118.47	4.15064	280.125	240.927
118.634	4.19879	293.359	238.164
118.798	4.21805	294.453	237.076
118.962	4.28546	311.563	233.347
119.126	4.22768	284.703	236.536
119.29	4.35287	325.781	229.733
119.454	4.29509	293	232.824
119.618	4.25657	311.797	234.931
119.782	4.17953	262.422	239.261
119.946	4.22768	308.969	236.536
120.11	4.09286	273.531	244.328
120.274	4.10249	317.859	243.755
120.438	4.22768	237.32	236.536
120.602	4.21805	276.391	237.076
120.767	4.24694	255.313	235.464
120.931	4.19879	302.813	238.164
121.095	4.24694	279.094	235.464
121.259	4.34324	284.172	230.243
121.423	4.18916	280.453	238.711
121.587	4.15064	238.391	240.927
121.751	4.22768	308.516	236.536
121.915	4.12175	288.234	242.616
122.079	4.12175	267.609	242.616
122.243	4.13138	311.031	242.05
122.407	4.15064	261.969	240.927
122.571	4.0736	276.688	245.483
122.735	4.19879	257.25	238.164
122.899	4.25657	277.828	234.931
123.063	4.25657	294.984	234.931
123.227	4.21805	256.969	237.076
123.391	4.13138	261.375	242.05
123.555	4.17953	291.797	239.261
123.719	4.28546	302.422	233.347
123.883	4.15064	273.141	240.927
124.047	4.02545	283.5	248.42
124.211	4.12175	302.281	242.616
124.375	4.24694	279.297	235.464
124.539	4.09286	301.094	244.328
124.703	4.18916	289	238.711
124.868	4.12175	290.375	242.616
125.032	4.00619	310.547	249.614
125.196	3.99656	313.188	250.215
125.36	4.12175	293.734	242.616
125.524	4.12175	278.922	242.616
125.688	4.02545	290.469	248.42
125.852	4.18916	293.219	238.711
126.016	4.05434	282.063	246.65
126.18	4.19879	278.922	238.164
126.344	4.12175	291.75	242.616
126.508	4.17953	247.789	239.261
126.672	4.15064	259.172	240.927
126.836	4.15064	253.234	240.927
127	4.18916	295.203	238.711
127.164	4.09286	304.531	244.328
127.328	4.24694	273.266	235.464

127.492	4.12175	244.844	242.616
127.656	4.21805	286.156	237.076
127.82	4.19879	290.063	238.164
127.984	4.13138	252.602	242.05
128.148	4.10249	267.531	243.755
128.312	4.25657	273.063	234.931
128.476	4.17953	272.328	239.261
128.64	4.0736	306.188	245.483
128.804	4.24694	247.125	235.464
128.969	4.29509	287.047	232.824
129.133	4.25657	266.906	234.931
129.297	4.32398	262.078	231.268
129.461	4.12175	254.477	242.616
129.625	4.24694	318.844	235.464
129.789	4.35287	249.156	229.733
129.953	4.38176	274.313	228.219
130.117	4.31435	259.172	231.785
130.281	4.34324	225.773	230.243
130.445	4.42028	265.25	226.23
130.609	4.38176	279.75	228.219
130.773	4.42028	266.438	226.23
130.937	4.50695	256.297	221.879
131.101	4.56473	273.453	219.071
131.265	4.44917	278.75	224.761
131.429	4.47806	290.625	223.311
131.593	4.56473	248.461	219.071
131.757	4.69956	268.203	212.786
131.921	4.6803	236.078	213.662
132.085	4.80549	279.313	208.095
132.249	4.75734	287.344	210.202
132.413	4.73808	265.516	211.056
132.577	4.82475	263.094	207.265
132.741	4.95957	295.156	201.63
132.906	5.05587	266.5	197.79
133.07	5.17143	274.5	193.37
133.234	5.19069	268.438	192.652
133.398	5.21958	275.156	191.586
133.562	5.34478	312.469	187.099
133.726	5.46997	262.359	182.816
133.89	5.50849	261.016	181.538
134.054	5.6722	254.836	176.298
134.218	5.70109	240.898	175.405
134.382	5.84554	238.18	171.07
134.546	5.95148	275.078	168.026
134.71	6.00926	275.781	166.41
134.874	6.15371	274.859	162.504
135.038	6.33668	267.5	157.811
135.202	6.58707	286.719	151.813
135.366	6.68337	233.703	149.625
135.53	7.10709	270.078	140.704
135.694	7.38637	265.531	135.385
135.858	8.06048	303	124.062
136.022	8.22419	280.984	121.593
136.186	8.47457	259.141	118
136.35	8.95608	249.961	111.656
136.514	8.53236	272.953	117.201
136.678	8.53236	307.219	117.201
136.842	8.58051	273.641	116.543
137.007	8.67681	253.547	115.25
137.171	8.69607	248.461	114.994
137.335	8.59977	314.281	116.282
137.499	8.59977	295.453	116.282
137.663	8.26271	287	121.026
137.827	8.15678	261.219	122.597
137.991	8.03159	280.656	124.508
138.155	7.73305	274.953	129.315
138.319	7.57897	324.141	131.944
138.483	7.55008	291.891	132.449

138.647	7.48267	266.672	133.642
138.811	7.31896	270.391	136.631
138.975	7.2034	302.031	138.823
139.139	7.01079	289.078	142.637
139.303	7.0782	250.852	141.279
139.467	6.90486	244.117	144.826
139.631	6.693	235.141	149.41
139.795	6.76041	213.047	147.92
139.959	6.65448	209.133	150.275
140.123	6.68337	209.156	149.625
140.287	6.77967	204.07	147.5
140.451	6.85671	234.438	145.843
140.615	6.84708	226.148	146.048
140.779	7.00116	246.227	142.833
140.943	7.0782	221.07	141.279
141.108	7.23229	230.805	138.269
141.272	7.35748	200.203	135.916
141.436	7.29007	238.938	137.173
141.6	7.45378	258.5	134.16
141.764	7.45378	225.719	134.16
141.928	7.51156	243.711	133.128
142.092	7.2997	239.344	136.992
142.256	7.22266	233.039	138.453
142.42	7.14561	243.984	139.946
142.584	7.10709	245.313	140.704
142.748	7.19377	258.797	139.009
142.912	7.41526	251.758	134.857
143.076	7.32859	195.781	136.452
143.24	7.25155	219.867	137.902
143.404	7.16487	263.313	139.57
143.568	7.01079	249.648	142.637
143.732	7.01079	224.281	142.637
143.896	6.76041	217.641	147.92
144.06	6.65448	244.672	150.275
144.224	6.56781	245.133	152.258
144.388	6.55818	236.227	152.481
144.552	6.40409	192	156.15
144.716	6.45224	215.609	154.985
144.88	6.25964	242.195	159.754
145.044	6.33668	229.375	157.811
145.209	6.25964	253.445	159.754
145.373	6.50039	248.031	153.837
145.537	6.05741	253.93	165.087
145.701	5.85517	261.359	170.789
145.865	6.23075	216.813	160.494
146.029	5.98037	227.977	167.214
146.193	5.8648	214.734	170.509
146.357	5.81665	268.516	171.92
146.521	5.92259	251.992	168.845
146.685	5.89369	251.414	169.673
146.849	5.75887	253	173.645
147.013	5.72998	266.281	174.521
147.177	5.65294	255.859	176.899
147.341	5.44108	248.656	183.787
147.505	5.31589	277.266	188.115
147.669	5.34478	267.891	187.099
147.833	5.41219	225.344	184.768
147.997	5.37367	231.398	186.093
148.161	5.26774	306.484	189.835
148.325	5.23884	269.656	190.882
148.489	5.17143	231.375	193.37
148.653	5.12328	307.219	195.187
148.817	4.99809	203.008	200.076
148.981	4.93068	310.047	202.812
149.145	5.02698	281.469	198.927
149.31	4.98846	241.813	200.463
149.474	5.09439	275.188	196.294
149.638	5.02698	263.125	198.927

149.802	5.05587	282.281	197.79
149.966	5.0655	272.141	197.414
150.13	5.04624	199.469	198.167
150.294	4.9692	229.789	201.24