

MEMORANDUM

Date: March 26, 2012
To: Water Right File 63-12064
From: medl
Re: license review

In my Initial review of the field exam report for this permit, I did not agree that the examiner had found beneficial use. I requested additional information from the permit holder. I received a response to my request from Kari Wheaton, Larry Wheaton's widow. Mrs. Wheaton provided photographs, invoices and other information which confirmed beneficial use and made it possible for me to estimate the heating use in the greenhouses which no longer exist.

This permit was approved during a moratorium. To allow processing to continue, it was paired with transfer 4234 which would have acted on WR 63-3181. The transfer was rescinded in 2008 and 63-3181 was decreed as it was licensed.

Applicant

The permit was issued to Larry Wheaton only. Mr. Wheaton and a partner founded a business called Idaho Native Nursery. It was short-lived and there is no record of it in IDSOS. Mr. Wheaton and his partner did not agree about business operations and the partnership was dissolved amid court proceedings.

According to available Canyon County taxlot information, the point-of-diversion and place-of-use are within property owned by Larry E Wheaton. The license will be issued in the name of Larry Wheaton.

The address given by the contemporary taxlot layer is the same as the address submitted on the 1997 field exam report. The IDWR contact record is in error and will be corrected.

Source & Point of Diversion

The source water for this use is an existing, low-temperature geothermal well. The well was drilled in 1960 and also serves water right 63-3181 for irrigation use. The examiner for 63-3181 reported the water temperature as 106 deg F.

The well has not been GPSd and had not been correctly positioned in the well layer of IDWRs database. I provided the complete well log and the well location as determined by the field examiner, to state office groundwater resource personnel. A well shape has been created and is the POD selected for this right.

Water Use

Beneficial use of the water was not confirmed during the field exam. The examiner visited the site on November 25, 1997, which was during the authorized season-of-use (11/16 - 3/14), however, the system was off. The examiner found empty greenhouse frames and the system piping which served them. He provided a system description, system diagram and photos, but no measurements were taken.

In spite of the lack of field verification, I believe that beneficial use of the water for heating occurred during the development period of this permit. Quantifying the heating use has been difficult. Lacking concrete information about the volume of water historically used or the true heat transfer capability of the system, I estimated the rate and volume for this license based on calculations of heat use in 4 hypothetical greenhouses.

Space Heating

The examiner found 4 greenhouses and described two heating systems in each greenhouse. The first system was a soil heating system. One or more circuits of 0.5 inch PVC tubing, were buried in the sandy floor of each greenhouse. The geothermal water flowed through the tubes, warming the tubing, then the surrounding sand and eventually the air of the greenhouses. In essence, the floor of each greenhouse became a large radiator.

Reviewing the design literature for this type of system, I found that the soil surface temperature can be too hot for workers or for plants grown on or near the floor and still not meet the peak design heat load. As a consequence, soil heating is typically used in conjunction with another heating system.

The examiner described a second heating system as: one or two radiators with fans which were located at each end of the greenhouses. No information about these radiator heaters was supplied by the examiner. Kari Wheaton provided invoice evidence that units were purchased and one photo, also provided by Mrs. Wheaton, shows a water-to-air, fan coil unit in place.

I believe that the examiner found unit heaters which are typically used in conjunction with soil heating systems. And I believe that the Wheaton greenhouses were designed with soil heating panels supplying the base heat load and unit heaters providing the peak heat load. I assumed that all the unit heaters were water-to-air and that they were operated in the typical, or preferred design for their use with a soil heating system. The same water is typically cascaded from one system to the other. First the water is run into the unit heaters first and then to the embedded soil circuits.

Other uses

According to the field examiner, the geothermal discharge storage pond provides stockwater and irrigation in the greenhouse. The pond is larger than can be covered by 24-hour storage rule for the irrigation right.

Kari Wheaton stated that she and her husband had investigated the requirements for getting this pond approved as a wildlife sanctuary/refuge but chose not to complete the process.

Rate and Volume

The examiner makes rate and volume recommendations based on a theoretical pump calculation and the upper limit authorized by the permit. This method over-estimates the rate and volume and is dissociated from the heating use.

The irrigation pump is oversized for the heating use. In his narrative, the examiner explains that water in excess of the heating system requirements, is shunted directly to the pond through a second, 6-inch pipe.

The examiner's pipe diagram indicates that a lower flow rate for the heating use was more likely than his recommendation. The heating system was designed and built later in time but used the existing well and well pump. The rate I recommend is based on the probability that the system designer would have laid new pipe compatible with the flow and velocity expected from the new use. The examiner described 2-inch PVC pipe serving the heating system discharge. The maximum recommended velocity for pvc pipe is 5 fps. 2-inch, schedule 40, pvc pipe could deliver ~50 gpm or 0.11 cfs in a low pressure (less than 20 psi) use such as the Wheaton greenhouse heating system. 2-inch pvc pipe cannot deliver the 0.6 cfs recommended by the examiner.

My recommendation for volume is based on hypothetical designs of the 4 greenhouses. In total, the 4 virtual greenhouses require 1,563,300 BTU/hr to maintain 68 deg F target internal temperature.

I calculated a space heating volume based on an adaptation of an ASHRAE method for estimating heat energy use. The equation is: $Vol = (HL \times HDD \times hr/day \times Cd) / (\Delta T1 \times K \times C \times \Delta T2)$. I used climate information from Boise (KBOI 101022), the nearest weather station to the POU.

The following parameters values were used:

HL = 1,563,300 BTU/hr based on 4 virtual greenhouses
HDD = 4716 (KBOI Nov16, 1984 – Mar 14, 1984 base 65 for the coldest year)
24 hr/day
Cd = 0.85 (Geo-Heat recommendation for greenhouses)
Delta T1 = 66 (design indoor temp, 68 deg F minus design outdoor temp, 2 deg F)
K = 0.9
C = 2720000 (constant to correct for units)
Delta T2 = 38 (source water temp, 106 deg F minus discharge temp, 68 deg F)

Place of Use

The place-of-use was part of an irrigated field in 1994, when the permit was approved. The examiner found 4 greenhouses in place at the time of his exam. They no longer exist but contemporary aerial photography shows that the place of use has not been returned to irrigation. I created the place-of-use shape based on available aerial photography. The greenhouses are visible in imagery from 2000. For ease of reference I have attached screen shots of my ArcMap setup.

Point of discharge

The heating system discharges the geothermal water to an excavated pond on the permit holder's property. A separate, domestic geothermal well, which serves the permit holder's house, also discharges spent water into this pond. The pond cools the discharged water before it is reused. The field examiner found stockwatering, commercial use as greenhouse irrigation, and storage of water for use in the traditional irrigation season.

Combined Use

POU and POD overlap analysis found only WR 63-3181 for irrigation use. Other uses found by the examiner may not be authorized.

Recommendation Summary

The rate and volume for this right are based on estimates of use rather than confirmation of use.

I recommend 0.11 cfs for rate and 24.5 AF for volume.

1994 IMAGERY

Table of Contents



☐ t02n02w.sid - Band_1

Value
High : 243

Low : 0

☐ t02n02w.sid - Band_2

Value
High : 241

Low : 13

☐ t02n02w.sid - Band_3

Value
High : 251

Low : 18

☒ t02n02w.sid - Band_1

Value
High : 255

Low : 0

☒ t02n02w.sid - Band_2

Value
High : 255

Low : 28

☒ t02n02w.sid - Band_3

Value
High : 255

Low : 25

☐ DRG

☒ Imagery

☐ 1987

☐ 1992 1 meter

☐ 2011 1 meter

☐ 2009 1 meter

☐ 2006 2 meter

☐ 2006 1 meter

☐ 2004 1 meter



2000 IMAGERY

- Layers**
- ☒ Wells
 - ☒ Spatial Data
 - ☒ Water Right POD
 - ☒ 63-12064_pou
 - ☒ PLSS
 - ☒ Township/Range
 - ☒ Sections
 - ☒ QQ
 - ☐ Water Right POU
 - ☒ Taxlots
 - ☒ t02n02w.sid - Band_1
 - Value
 - High : 243
 - Low : 0
 - ☒ t02n02w.sid - Band_2
 - Value
 - High : 241
 - Low : 13
 - ☒ t02n02w.sid - Band_3
 - Value
 - High : 251
 - Low : 18
 - ☐ t02n02w.sid - Band_1
 - Value



History for Boise, ID

November 16, 1984 through March 14, 1985

November 16, 1984 through March 14, 1985

November 16 1984 - TO - March 14 1985

	Max	Avg	Min	Sum
Temperature				
Max Temperature	51 °F	33 °F	10 °F	
Mean Temperature	40 °F	25 °F	0 °F	
Min Temperature	37 °F	18 °F	-11 °F	
Degree Days				
Heating Degree Days (base 65)	64	40	25	4716
Cooling Degree Days (base 65)	0	0	0	0
Growing Degree Days (base 50)	0	0	0	0
Dew Point				
Dew Point	38 °F	18 °F	-18 °F	
Precipitation				
Precipitation	10.45 in	0.12 in	0.00 in	13.47 in
Snowdepth	5.0 in	2.5 in	1.0 in	-
Wind				
Wind	41 mph	7 mph	0 mph	
Gust Wind	38 mph	29 mph	23 mph	
Sea Level Pressure				
Sea Level Pressure	30.90 in	30.23 in	29.53 in	

Meaning of acronyms:

DB: Dry bulb temperature, °F

MCWB: Mean coincident wet bulb temperature, °F

WB: Wet bulb temperature, °F

Lat: Latitude, °

DP: Dew point temperature, °F

MCDB: Mean coincident dry bulb temperature, °F

Long: Longitude, °

HR: Humidity ratio, grains of moisture per lb of dry air

HDD and CDD 65: Annual heating and cooling degree-days, base 65°F, °F-day

Elev: Elevation, ft

WS: Wind speed, mph

Station	Lat	Long	Elev	Heating DB		Cooling DB/MCWB			Evaporation WB/MCDB		Dehumidification DP/HR/MCDB		Extreme		Heat/Cool.													
						Annual WS			Degree-Days																			
				99.6%	99%	0.4%	1%	2%	0.4%	1%	0.4%	1%	1%	2.5%	5%	HDD / CDD 65												
VALDOSTA WB AIRPORT	30 78N	83 28W	197	27.5	30.9	95.4	77.4	93.4	76.6	91.8	76.1	80.4	89.8	79.3	88.6	78.3	148.0	83.4	77.1	142.2	82.5	17.1	14.9	13.1	1509	2532		
WARNER ROBINS AFB	32 63N	83 60W	302	25.0	28.2	97.3	76.1	94.9	76.0	92.8	75.3	79.8	90.9	78.5	89.5	76.9	141.6	84.5	75.5	135.0	82.9	19.0	16.5	13.9	2135	2246		
																		4 sites, 4 more on CD-ROM										
Hawaii																						19.6	17.8	16.3	0	4418		
BARBERS POINT NAS	21 30N	158 07W	33	59.4	61.6	90.9	73.0	89.9	73.0	88.8	72.8	77.6	85.7	76.5	85.1	75.2	132.3	82.7	73.7	125.4	82.1	17.6	15.8	13.5	0	3258		
HILO INTERNATIONAL AP	19 72N	155 05W	36	61.5	62.7	85.6	74.1	84.6	73.9	83.8	73.7	76.7	82.1	76.0	81.5	75.1	131.9	79.2	74.2	127.8	78.6	21.8	20.0	18.7	0	4649		
HONOLULU INTL ARPT	21 33N	157 94W	16	61.2	63.3	89.9	74.0	89.1	73.6	88.2	73.4	77.2	84.8	76.3	84.2	75.0	131.3	81.3	73.9	126.3	80.6	19.3	17.6	16.2	0	4297		
KANEOHE BAY MCAS	21 45N	157 77W	20	64.3	66.2	85.3	74.6	84.3	74.2	83.6	73.9	77.4	82.2	76.4	81.7	75.6	133.9	80.5	74.6	129.7	80.1	7 sites, 7 more on CD-ROM						
Idaho																						21.8	19.0	17.1	5658	890		
BOISE AIR TERMINAL	43 57N	116 22W	2867	2.7	10.5	98.1	64.2	95.0	63.1	91.9	62.1	66.3	91.7	65.0	90.0	57.8	79.4	72.2	55.5	72.8	72.3	21.4	18.8	16.6	5698	638		
CALDWELL (AWOS)	43 63N	116 63W	2428	11.6	16.4	97.0	66.4	93.1	65.0	90.4	63.9	68.3	92.1	66.7	89.8	60.6	86.5	77.5	57.1	76.1	77.3	22.4	18.9	16.8	6892	286		
COEUR D'ALENE(AWOS)	47 77N	116 82W	2320	6.7	11.6	91.4	62.8	88.5	62.3	84.2	60.8	65.6	86.3	63.9	83.8	57.4	76.6	70.9	55.4	71.2	69.6	22.4	18.9	16.8	6892	286		
IDAHO FALLS FANNING FIELD	43 52N	112 07W	4744	-8.7	-2.4	91.7	61.4	89.4	60.8	86.3	59.8	64.9	83.6	63.2	82.2	58.9	88.5	70.9	56.6	81.5	69.2	27.2	24.3	20.7	7825	275		
JOSLIN FLD MAGIC VA	42 48N	114 48W	4255	9.4	12.4	94.5	63.8	91.1	63.1	89.6	62.7	66.9	89.6	65.3	86.8	59.2	88.1	75.8	56.9	80.9	74.7	27.5	24.4	20.8	6157	700		
LEWISTON NEZ PERCE CNTY AP	46 38N	117 01W	1437	10.2	17.5	97.8	65.4	94.3	64.5	90.7	63.3	67.7	92.1	66.0	89.8	59.6	80.3	72.8	57.3	73.9	72.0	20.6	17.6	14.8	5124	814		
POCATELLO REGIONAL AP	42 92N	112 57W	4478	-4.9	1.3	94.4	61.8	91.3	61.1	88.3	60.2	65.4	86.5	63.7	84.4	58.9	87.7	71.2	56.3	79.7	70.6	28.1	25.0	21.9	7035	419		
																		14 sites, 6 more on CD-ROM										
Illinois																						25.9	22.8	19.8	6403	711		
AURORA MUNICIPAL	41 77N	88 47W	705	-2.0	1.4	90.8	74.4	88.4	73.5	85.7	71.8	77.7	87.2	75.9	84.3	74.8	133.9	83.2	73.0	125.6	80.9	20.6	18.4	16.5	4452	1396		
CAHOKIA/ST LOUIS	38 57N	90 15W	413	9.5	14.2	93.5	77.3	91.4	76.4	90.3	76.0	80.4	90.3	78.8	89.1	77.5	145.1	85.1	75.3	134.9	83.9	24.4	21.2	19.2	5930	1022		
CHICAGO MIDWAY AP	41 79N	87 75W	617	-1.6	4.3	92.1	74.9	89.6	73.3	86.5	71.9	78.0	88.3	76.2	85.4	75.0	134.1	84.3	73.0	125.5	82.2	24.4	21.2	19.2	6311	842		
CHICAGO OHARE INTL AP	41 99N	87 91W	673	-4.0	2.2	91.9	74.6	89.0	73.4	86.1	71.9	77.9	88.2	76.1	85.2	74.9	134.2	84.1	73.2	126.3	81.9	24.8	21.1	19.2	5529	1065		
DECATUR	39 83N	88 87W	699	-0.4	4.6	93.0	76.7	90.5	75.7	88.2	74.3	79.3	89.6	77.7	87.7	76.2	140.2	85.8	74.7	133.4	84.1	24.8	21.7	19.7	6227	902		
GLENVIEW NAS	42 08N	87 82W	653	-4.6	2.1	93.2	75.0	89.8	73.1	86.7	71.6	77.7	89.9	75.8	86.4	73.9	129.6	84.9	72.2	122.1	83.2	21.0	18.7	16.7	6141	999		
MOLINE QUAD CITY INTL AP	41 47N	90 52W	594	-6.2	0.0	93.5	76.3	90.6	75.1	87.7	73.5	79.1	89.7	77.4	87.5	76.1	139.5	85.3	74.4	131.7	83.1	24.6	20.7	18.7	6141	999		
PEORIA GREATER PEORIA AP	40 67N	89 68W	663	-3.6	2.3	92.7	76.5	90.1	75.3	87.4	73.3	79.3	89.0	77.7	87.0	76.5	141.4	85.0	74.9	133.9	83.2	23.8	20.2	18.3	5809	1035		
QUINCY MUNI BALDWIN FLD	39 94N	91 19W	768	-2.0	3.3	93.3	76.4	90.4	75.3	87.8	74.2	78.6	89.1	77.4	87.8	75.6	137.8	84.7	74.2	131.4	83.2	24.7	21.0	19.2	5552	1100		
ROCKFORD GREATER ROCKFORD AP	42 20N	89 09W	745	-8.4	-1.7	91.5	75.0	88.5	73.7	85.8	72.0	78.2	87.8	76.3	85.0	75.3	136.5	84.0	73.5	128.1	82.0	24.6	21.0	19.2	6694	779		
SCOTT AFB/BELLEVILLE	38 55N	89 85W	443	4.5	10.3	95.1	77.4	92.7	76.6	90.4	75.6	80.2	90.4	78.8	88.9	77.3	144.6	85.7	75.8	137.4	84.1	21.5	18.8	16.7	4638	1428		
SPRINGFIELD CAPITAL AP	39 85N	89 68W	614	-2.1	4.6	92.9	76.7	90.5	75.6	88.1	74.2	79.4	89.7	77.9	87.5	76.4	140.9	85.9	74.9	134.0	84.0	24.9	21.8	19.5	5429	1135		
UNIV OF ILLINOIS WI	40 03N	88 27W	774	-1.0	4.4	92.5	76.4	90.1	75.4	87.7	74.4	79.8	89.1	77.9	86.7	77.1	145.0	86.3	75.1	135.8	83.5	27.4	24.6	22.0	5657	1010		
W CHICAGO/DU PAGE	41 92N	88 25W	758	-5.4	0.6	90.5	74.9	88.1	73.8	85.1	72.0	78.3	87.3	76.4	84.7	75.3	136.5	84.4	73.4	127.6	81.6	24.5	21.0	19.0	6511	736		
																		8 sites, 1 more on CD-ROM										
Indiana																						20.7	18.5	16.6	4449	1410		
EVANSVILLE REGIONAL AP	38 04N	87 54W	387	5.6	12.1	93.9	76.2	91.6	75.7	89.5	74.9	79.4	89.8	78.1	88.1	76.4	139.9	85.2	75.3	134.4	83.6	24.6	20.8	18.8	6011	831		
FORT WAYNE INTL AP	41 01N	85 21W	827	-2.6	3.8	91.1	74.4	88.4	73.1	85.7	71.7	77.6	87.0	75.9	84.1	74.8	134.5	82.8	73.2	127.4	80.9	24.6	20.8	18.8	6011	831		
GRISSOM ARB	40 65N	86 15W	830	-3.9	3.4	92.4	75.8	89.4	74.8	86.7	72.9	79.2	89.0	77.3	85.9	76.3	141.8	85.5	74.5	133.2	83.1	24.9	20.6	18.4	5761	1025		
INDIANAPOLIS INTL AP	39 71N	86 27W	807	-0.5	6.4	91.1	75.3	88.6	74.4	86.3	73.1	78.2	87.6	76.9	85.5	75.4	137.1	83.4	74.1	131.2	82.1	24.5	20.8	18.7	5322	1055		
LAFAYETTE PURDUE UNIV AP	40 41N	86 94W	636	-2.3	4.2	92.4	75.6	90.0	74.6	87.5	73.2	78.8	88.7	77.2	86.3	75.9	138.6	84.8	74.4	131.8	82.9	23.1	20.0	18.3	5577	1003		
MONROE CO	39 13N	86 62W	866	4.8	10.2	90.6	76.0	89.6	76.1	87.5	74.7	78.9	86.7	77.6	86.0	76.7	143.8	83.7	74.9	135.1	82.3	19.5	17.5	15.8	4936	1009		
SOUTH BEND MICHIANA RGNL AP	41 71N	86 33W	774	-1.5	4.5	90.9	74.3	88.1	72.7	85.3	71.3	77.4	86.8	75.6	84.0	74.6	133.2	83.3	72.9	125.7	81.0	24.1	20.5	18.6	6188	810		
TERRE HAUTE/HULMAN	39 45N	87 32W	574	-0.3	6.6	92.1	76.6	90.1	75.9	87.8	74.6	79.6	88.9	78.0	86.9	76.9	143.2	85.4	75.2	134.9	83.5	22.8	19.5	17.9	5194	1085		
																		9 sites, 19 more on CD-ROM										
Iowa																						26.5	23.6	20.2	6388	794		
AMES MUNI ARPT	42 00N	93 62W	955	-5.8	0.5	90.5	76.1	88.3	74.9	85.6	73.8	79.2	87.4	77.3	85.6	76.8	144.5	84.9	74.8	134.9	82.7	20.7	18.4	16.5	5954	1063		
ANKENY REGIONAL ARP	41 68N	93 55W	902	-5.4	0.4	94.9	75.2	91.1	74.4	88.3	73.2	77.8	89.1	76.4	87.2	74.6	133.9	84.0	73.0	126.8	82.7	20.7	18.4	16.5	5954	1063		
BOONE MUNI	42 05N	93 85W	1161	-5.8	0.4	91.3	77.8	89.8	76.7	86.2	74.4	81.0	89.0	78.9	86.1	79.0	157.4	86.2	76.8	146.1	84.6	26.4	23.5	20.3	6328	894		
CEDAR RAPIDS MUNICIPAL AP	41 88N	91 71W	873	-9.6	-3.9	91.6	76.0	88.6	74.6	85.7	73.0	78.6	87.4	77.0	85.6	76.2	141.4	84.3	74.3	132.2	82.2	26.3	23.2	20.2	6703	807		
DAVENPORT NEXRAD	41 62N	90 58W	850	-3.4	1.3	90.3	76.2	88.1	75.4	84.4	73.3	78.5	87.0	77.1	85.2	75.4												

1 1/2 inches				
Volume Flow (gal/min)	Volume Flow (gal/hr)	Velocity (ft/sec)	Friction Head (ft/100 ft)	Friction Loss (psi/100 ft)
2	120	0.3	0.1	0.03
5	300	0.8	0.2	0.1
7	420	1.1	0.4	0.2
10	600	1.6	0.7	0.3
15	900	2.4	1.5	0.7
20	1200	3.2	2.6	1.1
25	1500	4.0	4.0	1.7
30	1800	4.9	5.5	2.4
35	2100	5.7	7.4	3.2
40	2400	6.5	9.4	4.1
45	2700	7.3	11.7	5.1
50	3000	8.1	14.3	6.2
60	3600	9.7	20.0	8.7

2 inches				
Volume Flow (gal/min)	Volume Flow (gal/hr)	Velocity (ft/sec)	Friction Head (ft/100 ft)	Friction Loss (psi/100 ft)
5	300	0.5	0.07	0.03
7	420	0.7	0.1	0.05
10	600	1.0	0.2	0.09
15	900	1.5	0.5	0.2
20	1200	2.0	0.8	0.3
25	1500	2.4	1.2	0.5
30	1800	2.9	1.6	0.7
35	2100	3.4	2.2	0.9
40	2400	3.9	2.8	1.2
45	2700	4.4	3.4	1.5
50	3000	4.9	4.2	1.8
60	3600	5.9	5.8	2.5
70	4200	6.8	7.8	3.4
75	4500	7.3	8.8	3.8
80	4800	7.8	9.9	4.3
90	5400	8.8	12.4	5.4
100	6000	9.8	15.0	6.5

2 1/2 inches				
Volume Flow (gal/min)	Volume Flow (gal/hr)	Velocity (ft/sec)	Friction Head (ft/100 ft)	Friction Loss (psi/100 ft)
5	300	0.3	0.04	0.02
7	420	0.5	0.05	0.02
10	600	0.7	0.1	0.04
15	900	1.0	0.2	0.08
20	1200	1.4	0.3	0.1
25	1500	1.7	0.5	0.2
30	1800	2.1	0.7	0.3
35	2100	2.4	0.9	0.4
40	2400	2.7	1.2	0.5
45	2700	3.1	1.4	0.6
50	3000	3.4	1.8	0.8
60	3600	4.1	2.5	1.1
70	4200	4.8	3.3	1.4
75	4500	5.1	3.7	1.6
80	4800	5.5	4.2	1.8
90	5400	6.2	5.2	2.3
100	6000	6.8	6.3	2.7
125	7500	8.6	9.6	4.2
150	9000	10.3	13.4	5.8

3 inches				
Volume Flow (gal/min)	Volume Flow (gal/hr)	Velocity (ft/sec)	Friction Head (ft/100 ft)	Friction Loss (psi/100 ft)
5	300	0.2	0.02	0.01
7	420	0.3	0.02	0.01
10	600	0.4	0.03	0.01
15	900	0.7	0.07	0.03
20	1200	0.9	0.1	0.05

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