4. USGS StreamStats for a region around Cherry Creek, Denver, CO

StreamStats Report

Region ID:

CO

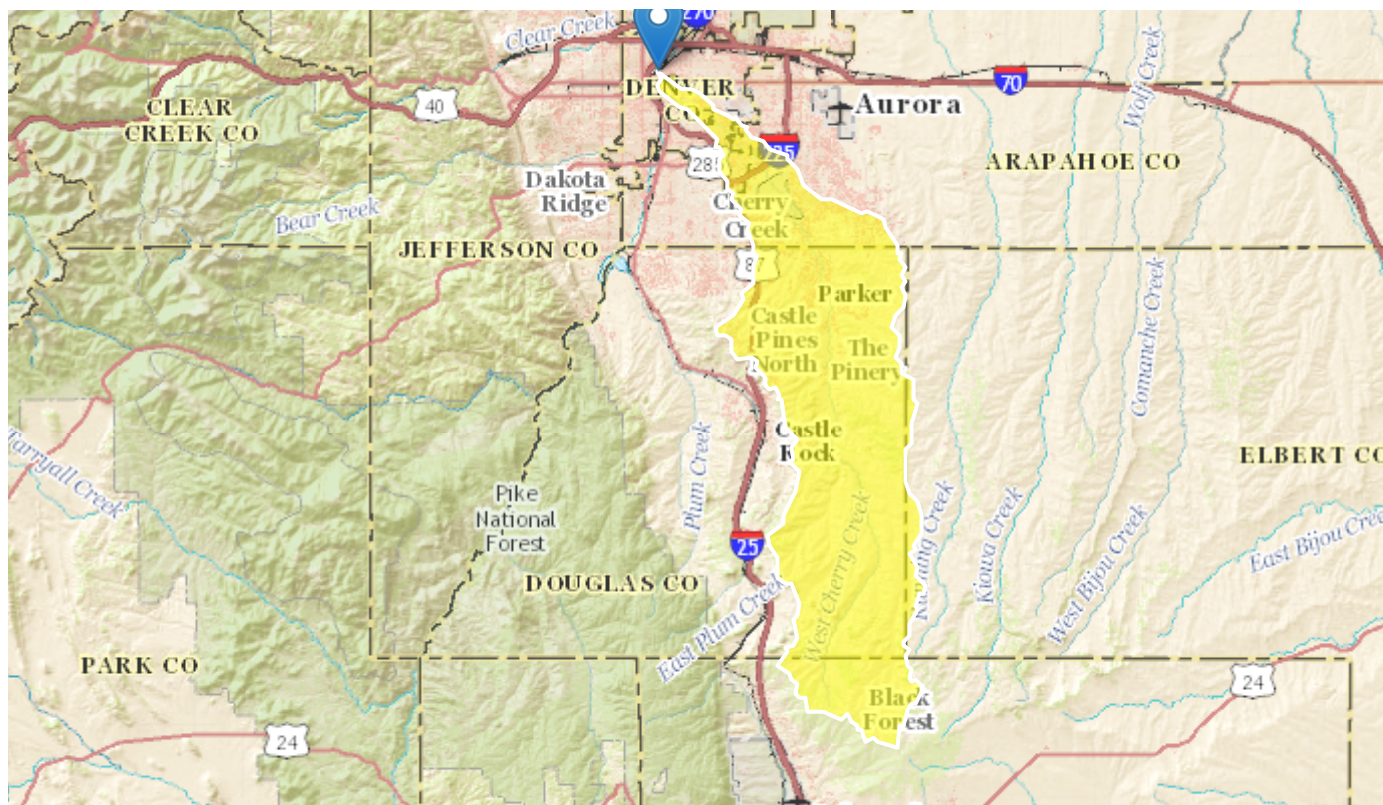**Workspace ID:**

CO20160907112021238000

**Clicked Point (Latitude, Longitude):**

39.75123,-105.00492

Time:

2016-09-07 11:24:17 -0600

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	410	square miles
PRECIP	Mean Annual Precipitation	19.66	inches
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	3.46	inches
ELEV	Mean Basin Elevation	6510	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	7.42	percent
EL7500	Percent of area above 7500 ft	3.36	percent
OUTLETELEV	Elevation of the stream outlet in feet above NAVD88.	5193	feet
STATSCLAY	Percentage of clay soils from STATSGO	18.42	percent

5. Daily discharge of a USGS station for the past 20 years

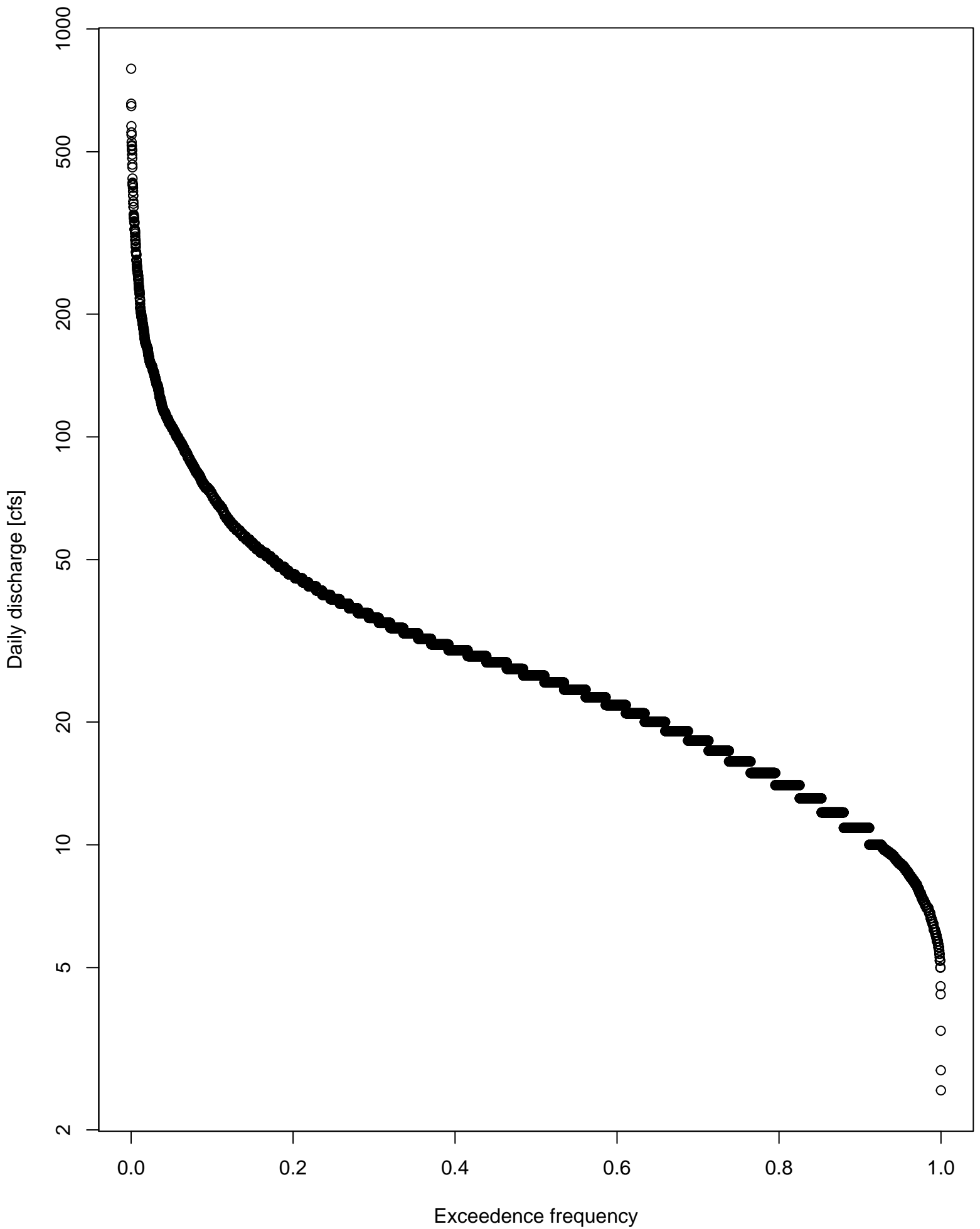**Daily discharege for Cherry creek (06713500), Denver, CO**
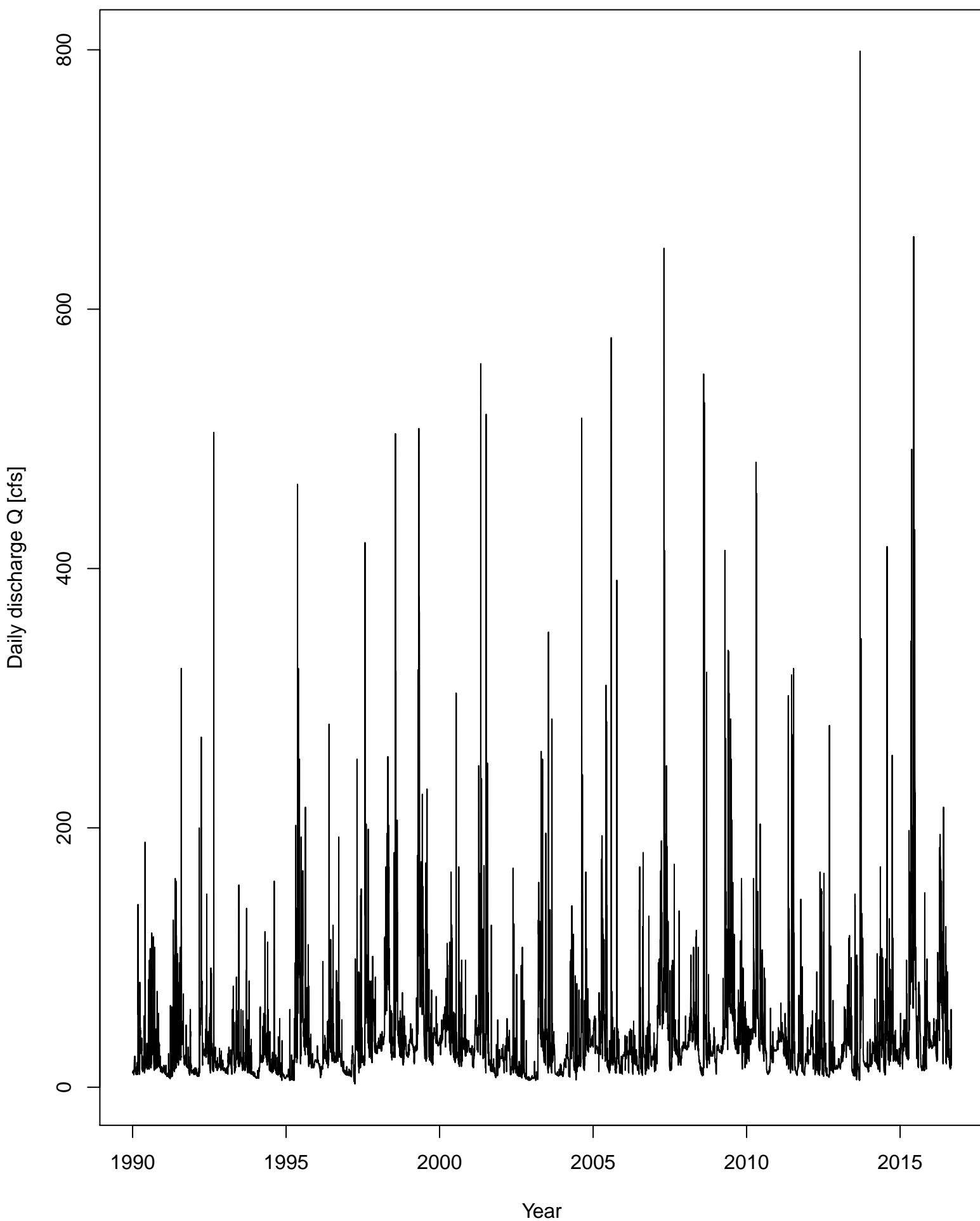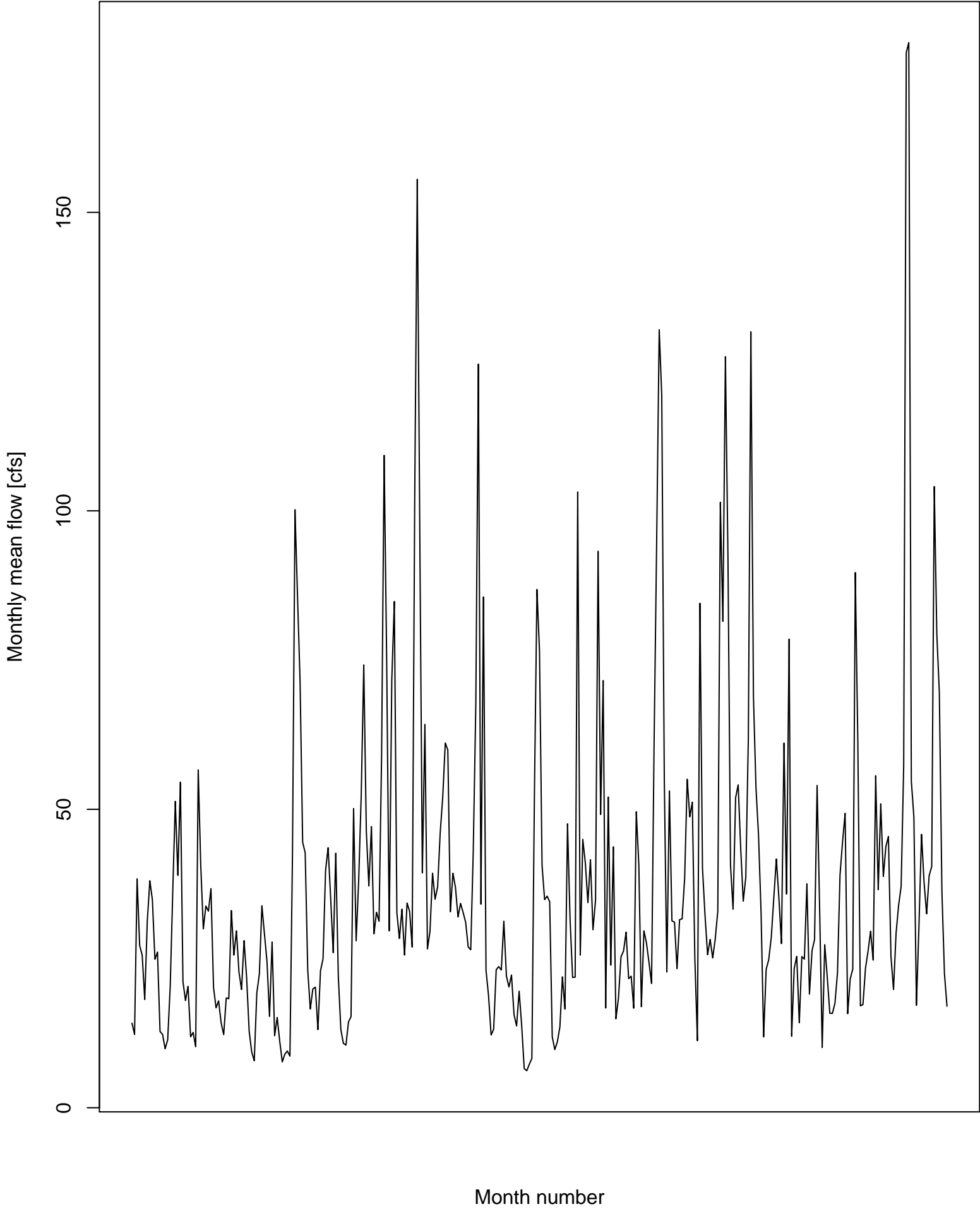
6. Annual maximum, average, 7 day minimum
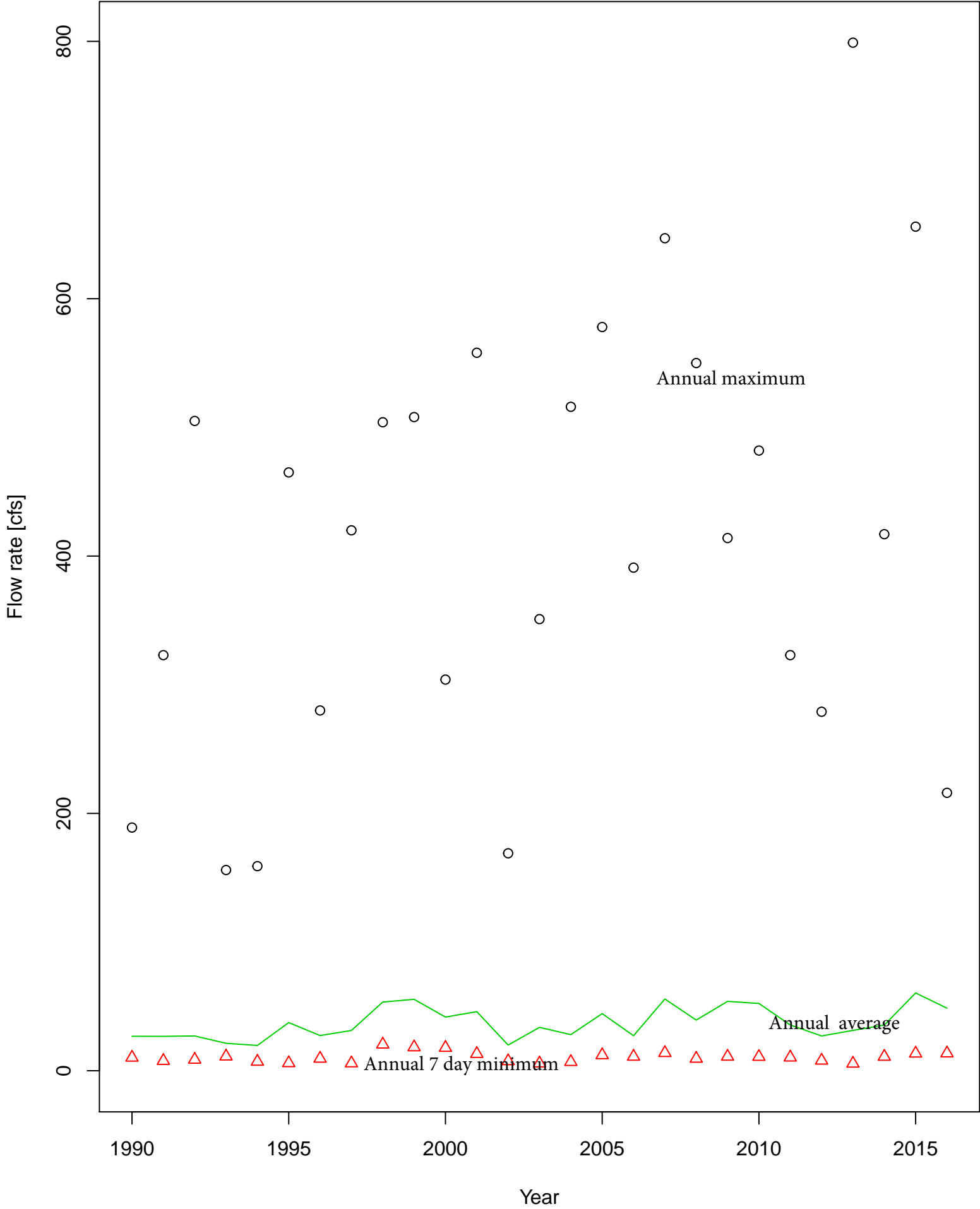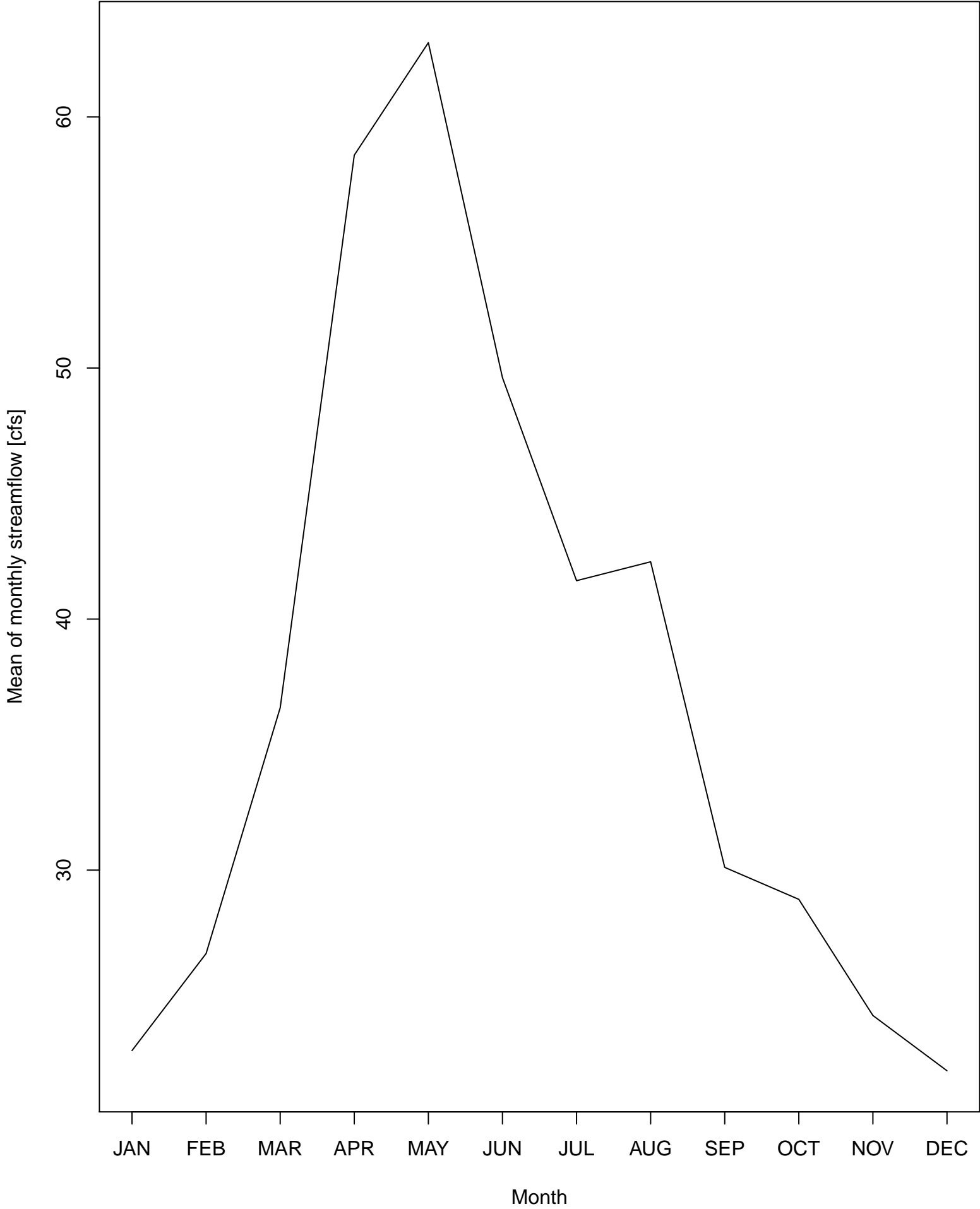
7. Flow duration curve
Daily flow that has a probability of exceeding 90% is ~ 11cfs

8. a) Monthly mean streamflow

Monthly mean flow [cfs]

Month number

8. b) Mean monthly streamflow

Mean of monthly streamflow [cfs]

Month

```
##Importing dataretrieval, ggplot tools
library(dataRetrieval)
library(ggplot2)

##Retrieve daily discharge for last 20 years
siteNo <- "06713500"
pCode <- "00060"
start.date <- "1990-01-01"
end.date <- "2016-09-01"
cherry_creek = readNWISdv(siteNo,"00060",start.date,end.date)


##Problem 5: Time series of daily discharge
Q=cherry_creek$X_00060_00003
dt=cherry_creek$Date
plot(dt,Q,type="l", xlab="Year", ylab="Daily discharge Q [cfs]")
title(main="Daily discharege for Cherry creek (06713500), Denver, CO")


##Problem 6: Average annual flow, peak flow, annual 7 day minimum flow
yy=as.numeric(format.Date(dt,"%Y")) #year
mo=as.numeric(format.Date(dt,"%m")) #month
wy=ifelse(mo>=10,yy+1,yy)
yrseq=unique(wy) #unique years
Qmean=rep(NA,length(yrseq)) #Annual Flow
Q7=rep(NA,length(yrseq)) #Annual 7 day min
Qmax=rep(NA,length(yrseq)) # Annual peak flow
#n=7 moving average function
ma7 <- function(x,n=7){filter(x,rep(1/n,n), sides=2)}
for(i in 1:length(yrseq)){
  yr=yrseq[i]
  #Average annual flow
  Qmean[i]=mean(Q[wy==yr])
  #Annual Peak flow
  Qmax[i]=max(Q[wy==yr])
  #Average 7 day minimum, which is the lowest of the flow rate sequence of 7 day
moving average daily discharge values
  Q7temp = Q[wy==yr]
  Q7[i] = min(ma7(Q7temp),na.rm=TRUE)
}
plot(yrseq,Qmax,ylim=c(0,max(Qmax)), ylab="Flow rate [cfs]", xlab = "Year")
lines(yrseq,Qmean, col = 3)
points(yrseq,Q7,pch=2,col=2)


##Problem 7: Flow duration curve
x=sort(Qmean)
n=length(Qmean)
nmid=n/2+0.5
x[nmid]
median(Qmean)
p=(1:n-0.4)/(n+0.2)
approx(p,x,0.25)
approx(p,x,0.75)
```

```r
quantile(Qmean,probs=c(0.25,0.5,0.75))
quantile(Q7,probs=c(0.25,0.5,0.75))
mean(Qmean)
sd(Qmean)
sd(Qmean)/mean(Qmean)
Qs=sort(Q)
n=length(Qs)
p=((1:n)-0.4)/(n+0.2)
plot(1-p,Qs,log="y",xlab="Exceedence frequency",ylab="Daily discharge [cfs]")
#To find daily flow that has a exceedance greater than 0.90
exceed = round(1-p,3)
q90 = mean(Qs[which(exceed == 0.900)])
print(q90)


##Problem 8: Monthly mean streamflow
# Monthly mean streamflow
yrmo=yy*100+mo
yrmoseq=unique(yrmo)
Qmonth=rep(NA,length(yrmoseq))
for(i in 1:length(yrmoseq)){
  ii=yrmoseq[i]
  Qmonth[i]=mean(Q[yrmo==ii])
}
plot(1:length(yrmoseq),Qmonth,type="l", xlab ="Month number", ylab = "Monthly
mean flow [cfs]", xaxt ='n')

#Mean of monthly streamflows
year=trunc(yrmoseq/100)
month=yrmoseq-year*100
Qmm=rep(NA,12)
for(mm in 1:12){
  Qmm[mm]=mean(Qmonth[month==mm])
}
plot(1:12,Qmm,type="l", xlab = "Month", ylab = "Mean of monthly streamflow
[cfs]", xaxt = 'n')
axis(side = 1, c(1:12), labels = c("JAN", "FEB", "MAR", "APR", "MAY", "JUN",
"JUL", "AUG", "SEP", "OCT", "NOV", "DEC"))
```