Curve Number Graph

Seth Younger

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Data for curve number graph.

First create a sequence of precipitation from 1 to 300 mm by 1 mm increments. Ten ccreate data for all of the curve numbers from 20 to 100 by 5. Generalte all of the possible combinations using expand.grid.

```r
cn_data <- expand.grid(precip_mm = seq(from = 1, to = 300, by = 1),
                       cn_value = seq(from = 20, to = 100, by = 5)) %>%
  mutate(cn_value = as.numeric(cn_value)) %>%
  mutate(cn = paste('CN', cn_value)) %>%
  mutate(S = 25400/cn_value - 254) %>%
  mutate(Q = ifelse(test = precip_mm > 0.2 * S,
                    yes = ((precip_mm - 0.2 * S)^2)/(precip_mm + 0.8 * S),
                    no = 0)) %>%
  mutate(Q = round(Q, 3))
```

Create points to label with curve numbers

```r
cn_points <- cn_data %>%
  filter(precip_mm == 190) %>%
  arrange(desc(cn_value)) %>%
  # where to start the CN 100 label
  mutate(point_placement = 180) %>%
  # how much each point moves up on the precip axis
  mutate(point_placement_incriment = 6.35) %>%
  mutate(point_placement_final = cumsum(point_placement_incriment) + point_placement) %>%
  mutate(point_placement_final = round(point_placement_final, 0)) %>%
  select(cn, cn_value, point_placement_final)

# combine the points with all of the data to find the slope at the points
points_data <- left_join(cn_data, cn_points) %>%
  filter(precip_mm >= (point_placement_final - 5) & precip_mm <= (point_placement_final + 5)) %>%
  group_by(cn) %>%
  # calculate max and min for slope
  mutate(max_p = max(precip_mm), min_p = min(precip_mm),
         max_q = max(Q), min_q = min(Q)) %>%
  mutate(rise = max_q - min_q,
         run = max_p - min_p) %>%
  mutate(slope = rise / run) %>%
  # convert slope of lines to degrees for plotting
  mutate(degrees = atan(slope) * 180/pi) %>%
  filter(precip_mm == point_placement_final) %>%
  ungroup()
```
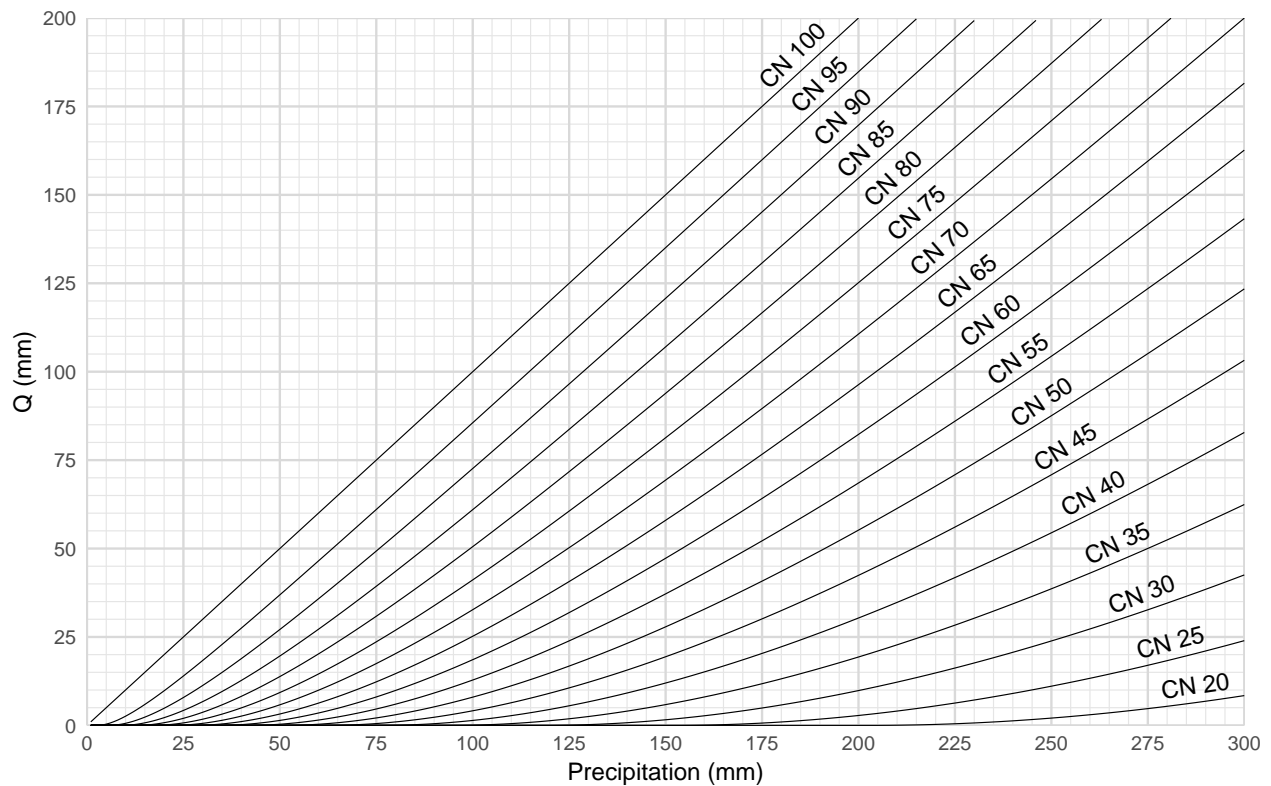
Curve number graph

```r
ggplot(data = cn_data, aes(x = precip_mm, y = Q, group = cn)) +
  geom_line(size = 0.25) +
  theme_minimal() +
  geom_text(data = points_data, aes(x = precip_mm, y = Q, label = cn, angle = degrees),
```

```
            vjust = -0.5, check_overlap = TRUE) +
  scale_y_continuous(breaks = seq(from = 0, to = 300, by = 25),
                     limits = c(0, 200), expand = c(0,0),
                     minor_breaks = seq(0, 200, 5)) +
  scale_x_continuous(breaks = seq(from = 0, to = 300, by = 25),
                     limits = c(0, 300), expand = c(0,0),
                     minor_breaks = seq(0, 300, 5)) +
  labs(x = 'Precipitation (mm)', y = 'Q (mm)') +
  theme(plot.margin=margin(t=0.3,r=0.5,b=0.1,l=0.1,unit="cm"),
        panel.grid.major = element_line(colour = "grey85"),
        panel.grid.minor = element_line(colour = "grey90"))
```


Save the curve number graph to a file.

```
ggsave(file = 'curve_number_graph.pdf', width = 20, height = 13, units = 'cm')
ggsave(file = 'curve_number_graph.tiff', width = 20, height = 13, units = 'cm')
ggsave(file = 'curve_number_graph.png', width = 20, height = 13, units = 'cm')
```