

# 2016 Rainfall Analysis

## *Executive Summary*

- The 2016 total rainfall volume was 47.14 inches, which is 30.2% above the historical average from 1981-2012.
- Compared to 2015, there were 6 more inches of rainfall recorded over an additional 21 days of rain.
- Rainfall in October was the highest on record at 11.21 inches, which was measured over a record-high span of 27 days of rain in that month.
- In addition, it is necessary to present issues that were experienced in regards to the quality of the rainfall data itself:
  - A new Master Telemetry Unit was installed on April 12<sup>th</sup>. An issue with the new system caused rainfall measurements at the Lakemont and I-405 rain gauges to be recorded inaccurately until the issue was resolved on December 8<sup>th</sup>. The inaccurate rainfall measurements were not apparent when rainfall amounts were relatively low, and this caused the problem to go unnoticed for a majority of the year.
  - There was also a number of isolated issues with the Crossroads, BSC, and NE 40<sup>th</sup> rain gauges reading inaccurately during shorter periods of time within the year. These issues were resolved by replacing the gauges. Rainfall amounts at these gauges have been estimated based on rainfall values from gauges which each is closest in proximity to, and these corrections have been documented.

## *Historical Rainfall Comparison*

The average annual rainfall for the period of record (1981 to 2013) is 36.02 inches, while the 2016 total was 47.14 inches<sup>1</sup>.

The following charts indicate that Bellevue rainfall during 2016 was somewhat unusual with respect to historical trends. A summary of these findings is outlined below.

- Five months of the year had rainfall totals higher than the expected range, and the total for one month fell below the expected range. Rainfall in the month of October established a new historical record for monthly high rainfall, while the total for the month of August was within one-tenth of an inch from setting a historical low record.
- Considerable variability in rainfall amounts were seen throughout the city. The lowest annual rainfall volume was recorded at Cherry Crest (381 ft. above sea level), where the gauge recorded 45.80 inches of rain. While the NE 40<sup>th</sup> gauge is situated at a similar elevation (391 ft. above sea level), this gauge recorded the highest annual volume of 54.15 inches. This variability can be seen spatially in **Appendix A**. A number of factors determine this variability, including elevation, as well as proximity to spatially small, but strong, storm cells.
- Bellevue experienced few storms this year, only one of which constituted a formal storm report and analysis. This storm event took place October 13<sup>th</sup>-16<sup>th</sup>, and was not representative of a traditional, wet season storm. Within a six-hour period of this long duration, there were 1.33

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<sup>1</sup> Rainfall totals refer to City of Bellevue gauge near I-405 & SR-520 interchange.

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## *Historical Rainfall Comparison, continued*

inches of rain recorded at the NE 40<sup>th</sup> gauge. This amount of rainfall corresponds to a 10-year storm event, which contributed to urban flooding.

- Over the past three years, the City's rainfall patterns have been outside historical patterns and the variation has not been consistent between years. It is uncertain whether the recent variability is an on-going trend, as our period of record is not sufficient to make assumptions about climate change.

## **Monthly Averages**

The charts on the following two pages show historical rainfall amounts. The first chart (bar graph) shows the historical (1981-2013) average monthly rainfall (grey) and the 2014, 2015, and 2016 totals (orange, blue, and red, respectively). The second chart is a box plot<sup>2</sup> showing historical monthly rainfall statistics, as well as monthly totals for 2014, 2015, and 2016.

## **Number of Rain Days**

In addition, a box plot is included in this report which shows statistics for the number of rain days experienced during the previous three years against the period of record (1990-2013). This plot is included to show just how often it rains each month. Note that the period of record shown begins in 1990, which was when the gauge was moved to its present location, since rainfall patterns vary by location within the city.

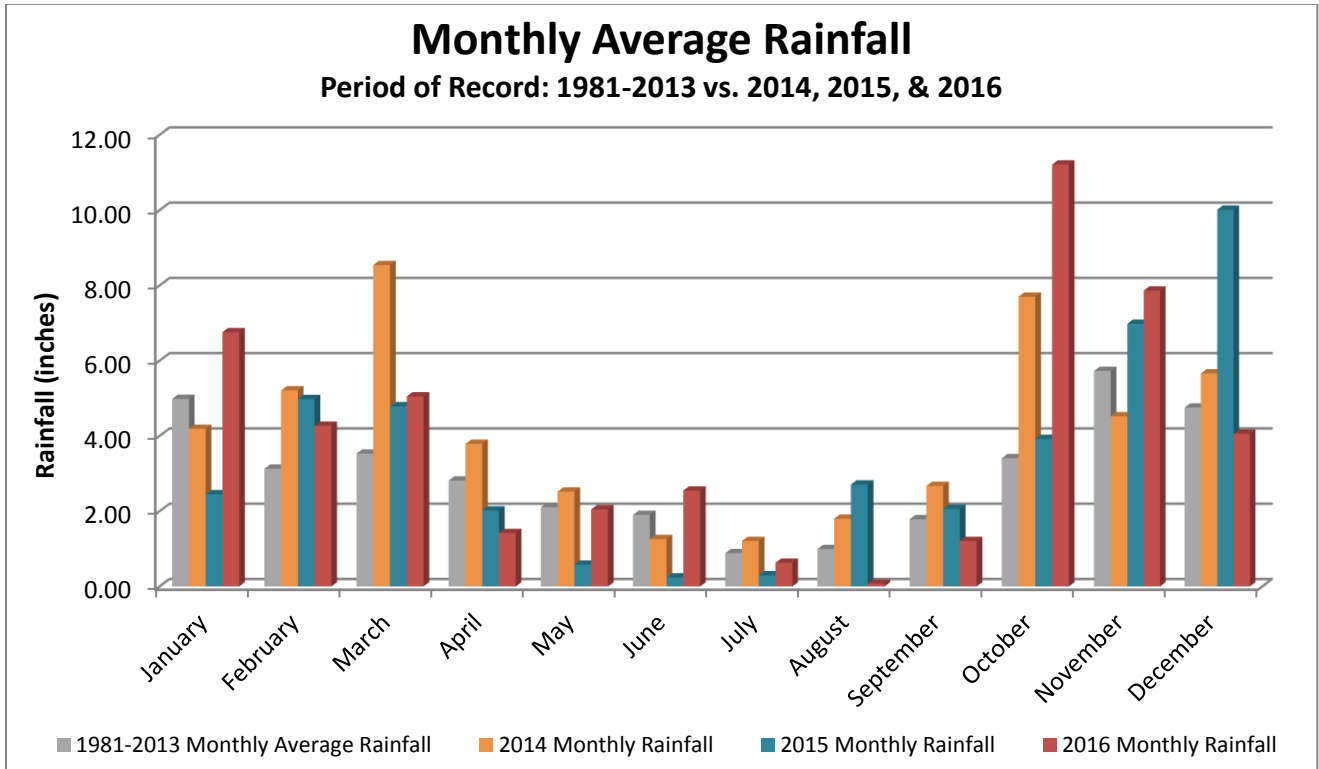
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<sup>2</sup> A box plot is a graphical depiction of a statistical summary of a dataset. The upper-most and lower-most boundaries of the box represent the upper and lower quartiles (75<sup>th</sup> and 25<sup>th</sup> percentiles), respectively. The line in the center of the box represents the median data point (50<sup>th</sup> percentile). The upper and lower points, connected to the box by vertical lines, represent the highest and lowest observed data points.

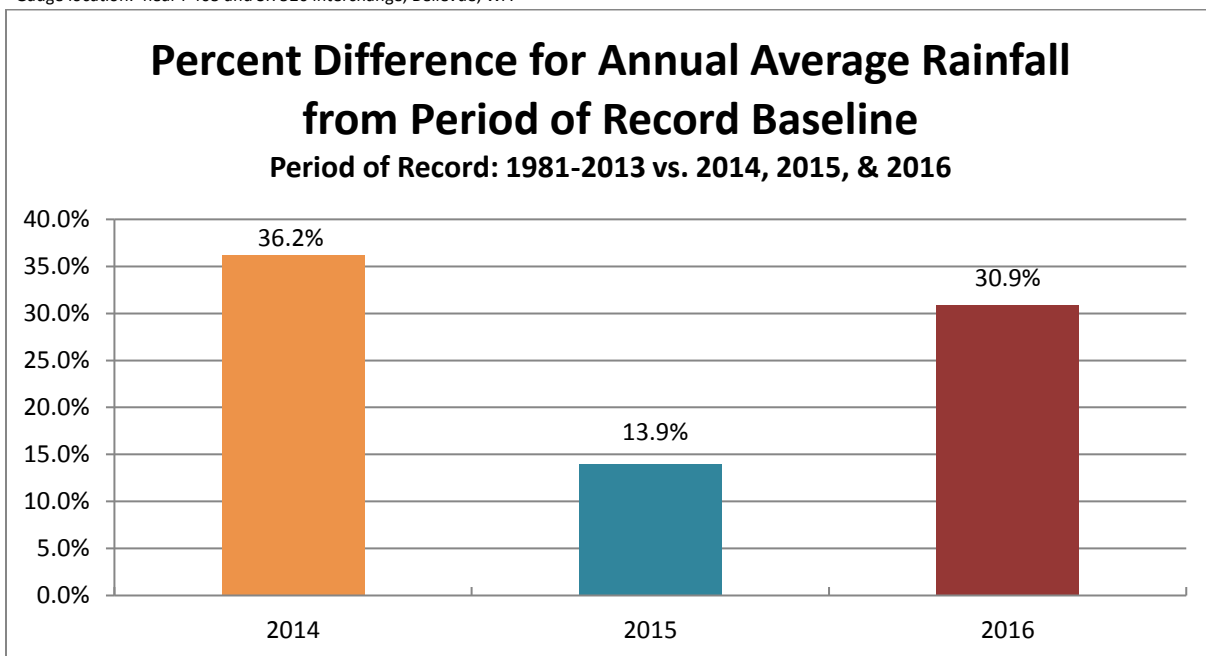
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## Monthly Averages: Chart 1

This chart shows the historical average monthly rainfall (grey) for the period of record (1981-2013) and the 2014, 2015, and 2016 totals (orange, blue, and red, respectively). The second chart displays the percent difference in annual average rainfall for 2013, 2014, 2015, and 2016, from the average for the period of record (1981-2013).



\*Gauge location: near I-405 and SR 520 interchange, Bellevue, WA

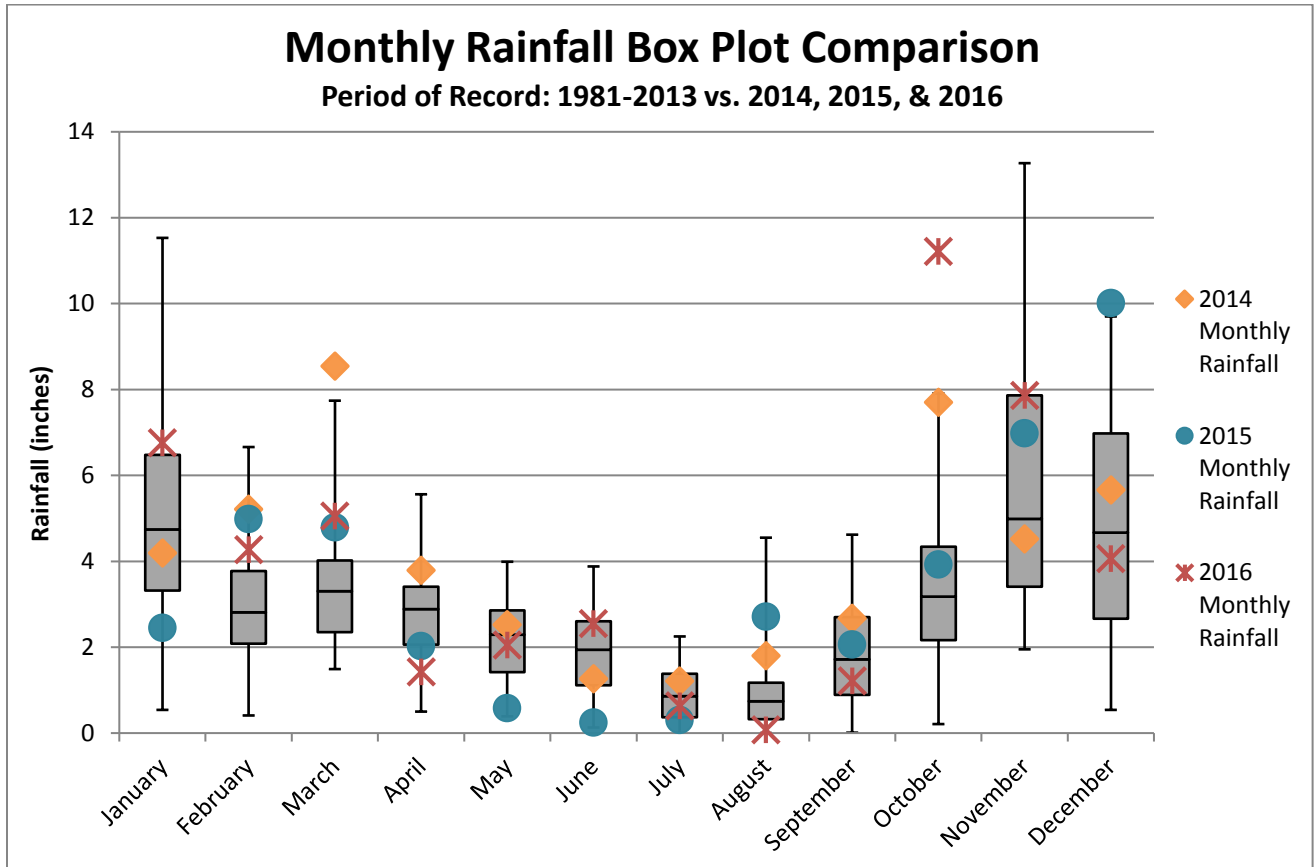


\*Gauge location: near I-405 and SR 520 interchange, Bellevue, WA

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## Monthly Averages: Chart 2

Below is a box plot<sup>3</sup> comparing monthly rainfall statistics for the period of record to monthly totals for 2014, 2015, and 2016. The historical monthly statistics are represented by the grey boxes, with 2014 represented by the orange diamond, 2015 represented by the blue circle, and 2016 represented by the red asterisk.



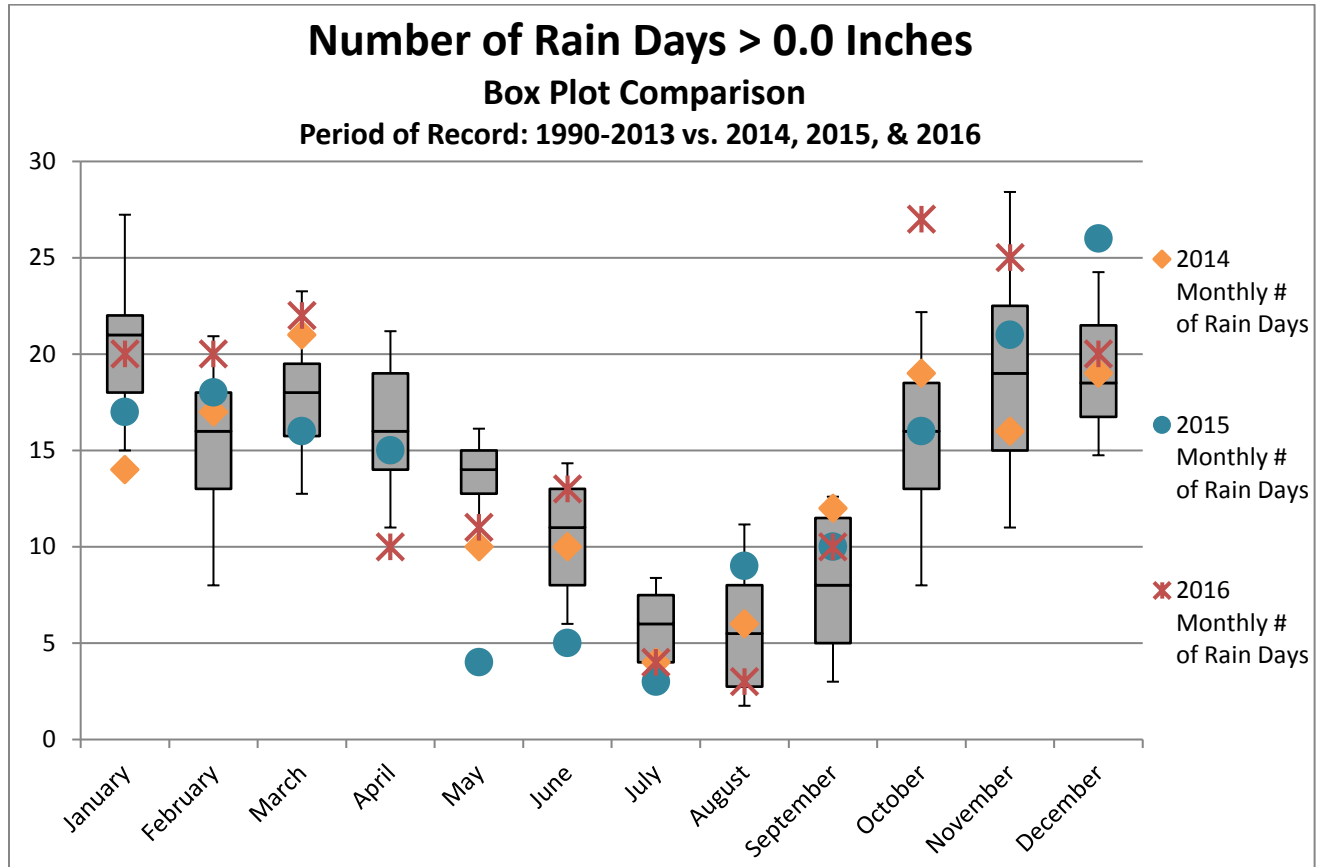
\*Gauge location: near I-405 and SR 520 interchange, Bellevue, WA

<sup>3</sup> A box plot is a graphical depiction of a statistical summary of a dataset. The upper-most and lower-most boundaries of the box represent the upper and lower quartiles (75<sup>th</sup> and 25<sup>th</sup> percentiles), respectively. The line in the center of the box represents the median data point (50<sup>th</sup> percentile). The upper and lower points, connected to the box by vertical lines, represent the highest and lowest observed data points.

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## Number of Rain Days Chart

The chart shown below is a box plot<sup>4</sup> showing statistics for the number of rain days, comparing the period of record to monthly totals for 2014, 2015, and 2016. The historical monthly statistics are represented by the grey boxes, with 2014 represented by the orange diamond, 2015 represented by the blue circle, and 2016 represented by the red asterisk. For this graph, the period of record begins in 1990 when the gauge was moved to its present location.



\*Gauge location: near I-405 and SR 520 interchange, Bellevue, WA

<sup>4</sup> A box plot is a graphical depiction of a statistical summary of a dataset. The upper-most and lower-most boundaries of the box represent the upper and lower quartiles (75<sup>th</sup> and 25<sup>th</sup> percentiles), respectively. The line in the center of the box represents the median data point (50<sup>th</sup> percentile). The upper and lower points, connected to the box by vertical lines, represent the highest and lowest observed data points.

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## Appendix A

- Blue circles indicate relative amount (inches) of rainfall recorded in 2016.  
Note: the Lakemont and I-405 gauges have been excluded from this map, due to the inaccuracy of the data for the majority of the year.

