## Introduction

Western Washington is typically associated with rain, green trees, and healthy environments, making the idea of drought in King County a far-fetched notion. There is a possibility for drought conditions in our area, as exemplified most recently in 2001. As a result, King County residents and employers need to be aware of the hazards presented by drought to our area.

Drought can be a result of multiple causes including "global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation."[1] Drought may be defined as a prolonged period of dryness severe enough to reduce soil moisture, water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.[2] While drought isn't typically thought of as a King County hazard, the historical record demonstrates that it is important to consider drought conditions as a potential impact to the region.

| | | |
|---|---|---|
| **High Probability Low Impact** | **High Probability Moderate Impact** | **High Probability High Impact** |
| **Moderate Probability Low Impact** | **Moderate Probability Moderate Impact** | **Moderate Probability High Impact** |
| **Low Probability Low Impact** | **Low Probability Moderate Impact** | **Low Probability High Impact** |

## Hazard Identification

The National Oceanic and Atmospheric Administration (NOAA) defines drought as less than 60% normal precipitation over a prolonged period of time.[3] However, in Washington State, the statutory criteria for drought is a water supply below 75% of normal and a shortage expected to create undue hardship for some water users.[4]

[1] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[2] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[3] Pierce County Hazard Identification and Vulnerability Assessment, http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/EMDiv/HIVA/DROUGHT.pdf
[4] Washington State Comprehensive Emergency Management Plan Annex Z2, Drought Contingency Plan, http://www.drought.unl.edu/plan/state%20plans/WAplan.pdf

Assessing the probability of drought conditions in King County can be challenging, due to the temperate weather nature of our region. As a result, current long-range forecasts of drought have limited reliability. Meteorologists do not believe that reliable forecasts are attainable any more than a season in advance.[5] If historic patterns repeat themselves, dry conditions occur approximately every decade. Probability of Drought conditions is Moderate – the potential Impact from Drought conditions is Moderate. See table
Drought conditions can be described in the following four ways:

Meteorological: a measure of departure of precipitation from normal. Due to climate differences what is considered a drought in one location may not be a drought in another.
Agricultural: refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
Hydrological: occurs when surface and subsurface water supplies are below normal.
Socioeconomic: refers to the situation that occurs when physical water shortage begins to impact people's jobs, incomes, recreational capabilities and other such factors.

The severity of drought is measured by the Palmer Drought Severity Index in a range of 4 (extremely wet) to –4 (extremely dry), and incorporates temperature, precipitation, evaporation and transpiration, runoff and soil moisture when designating the degree of drought.[6]

Table 5-13: Palmer Drought Severity Index Classifications

| | |
|---|---|
| 3.0 to 3.99 | Very Wet |
| 2.0 to 2.99 | Moderately Wet |
| 1.0 to1.99 | Slightly Wet |
| 0.5 to 0.99 | Incipient Wet Spell |
| 0.49 to -0.49 | Near Normal |
| -0.5 to 0.99 | Incipient Dry Spell |
| -1.0 to –1.99 | Mild Drought |
| -2.0 to –2.99 | Moderate Drought |
| -3.0 to –3.99 | Severe Drought |
| -4.0 or less | Extreme Drought |

Source: Pierce County Emergency Management Hazard Identification and Vulnerability Assessment, September 2002

[5] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[6] Governor's Ad Hoc Executive Water Emergency Committee Staff, "History of Drought in Washington State", State of Washington, December 1977, p 7.

In 1989, the Washington State Legislature gave permanent drought relief authority to the Department of Ecology and enabled them to issue orders declaring drought emergencies. (RCW 43.83B.400-430 and Chapter 173-166 WAC).[7]

In comparison to other natural disasters that may occur in Western Washington, drought doesn't usually result in property damage or loss of life, although it can have substantial negative impact on the environment and economy.

**History of Events**

Every few years in Washington State, drought conditions are present with an inherent impact of moderate on the Palmer Drought Severity Index. In the last century in Washington State, there have been a number of drought episodes, including several that have lasted for more that a single season, including dry periods occurring between 1928-1932 and 1992-1994.

However, King County experiences drought conditions of at least moderate severity in classification from 5 to 10 percent of the time, evidenced most prominently during our most recent severe drought periods in 1977 and 2001. The 1977 event set records for low precipitation, snow-pack, and stream flow totals that still stand today, while the 2001 event was the second-worst drought year in state recorded history.[8]

1977 Drought: King County experienced severe or extreme drought conditions between 10-20 percent of the time.

2001 Drought: At the height of this event in March 2001, King County experienced moderate to severe drought conditions.[9]

Rainfall for Western Washington during the 2001 water year was approximately 30% below normal. On March 14, 2001, after several months of record low precipitation, Governor Gary Locke authorized the Department of Ecology to declare a statewide drought emergency. Washington was the first Northwest state to make a drought declaration. Due to above-average precipitation during the final two months of the year, the drought emergency formally expired on December 31,

[7] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf
[8] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf
[9] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

2001. The National Weather Service reported that the winter of 2000-01 was the driest since 1976-1977, and was one of the top five driest in the past 100 years.[10]

**Table 5-14: Drought History**

| Year | Conditions | Causes |
|---|---|---|
| 2001 | Moderate to Severe Drought | Low precipitation |
| 1988 | Water Shortage;<br><br>Water Shortage | Level of Chester Morse Lake fell below outlet;<br>Tolt Pipeline broke during peak usage |
| 1987 | Water Shortage;<br>Water Shortage | Tolt Pipeline broke<br>Hot, dry summer weather increased water demands beyond limits |
| 1977 | Severe to Extreme Drought | Low precipitation |
| 1967 | Water Shortage | Dry summer |
| 1965-66 | Water Shortage | Dry throughout state |
| 1952-53 | Water Shortage | Lack of winter precipitation |
| 1928-30 | Statewide Drought | Rainfall was 20% of normal |
| 1919 | Water Shortage | Dry summer |

*Source: City of Seattle Emergency Management Disaster History, http://www.cityofseattle.net/emergency_mgt/hazards/disasterHistory.htm.*

## Hazard Impacts

Drought conditions occurring in King County can have an impact on the economic viability of agriculture- and power-related industries as well as water- and snow-related recreational activities. Drought conditions would impact the amount of water available for crops grown for commercial and domestic use, and could also reduce the snow pack available in our local mountain passes, which could have a negative result on area winter sports tourism.

Additionally, due to the prevalence of hydroelectric dams in King County, drought conditions could also have a negative impact on the availability and cost of electric power for local businesses and industries. When water levels drop, electric companies cannot produce enough power to meet demand and are forced to buy electricity from other sources.[11]

[10] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf

[11] King County Office of Emergency Management Drought Resource Section, http://www.metrokc.gov/prepare/prepareresponds/hazardsdisasters/droughts.aspx

Additional impacts to King County industry may include a negative impact on the capabilities of firefighters in the area, as water shortages may result in reduced water flow and pressure available to combat wild land and structural fires that may take place in our region.

**Past Mitigation Efforts**

Efforts to mitigate the effects of drought conditions in our area include consistent vigilance of forecasted conditions like the prevalence of rainfall, or the amount of snow pack present in the mountain passes.

Additonal efforts include King County's Regional Wastewater Services Plan, a 30-year operating plan for our wastewater system that calls for expanding the production and use of reclaimed water as a valuable resource. Reclaimed water is wastewater that gets treated to such a high level that it can be used safely and effectively for non-drinking water purposes such as landscape and agricultural irrigation, heating and cooling, and industrial processing. Reclaimed water has been used successfully and safely in other areas of the country and world for decades, and is a viable tool to utilize when combating drought in King County.[12]

Other mitigation efforts include sustainable landscaping, a low maintenance method of outdoor design featuring native plants that promotes healthy soil, minimizes water use, and doesn't need excessive fertilizer or pesticides.[13]

[12] King County Water Reuse Program, http://dnr.metrokc.gov/wtd/reuse/
[13] King County Solid Waste Division, Sustainable Landscaping, http://www.metrokc.gov/dnrp/swd/sustainable-landscaping/index.asp