Bangladesh Water Development Board

ANALYSIS OF WATER LEVEL ALONG THE BRAHMAPUTRA-JAMUNA, GANGA-PADMA & SURMA-MEGHNA RIVER SYSTEM

August 2020

Surface Water Processing Branch
BWDB, 72, Green Road, Dhaka.

Bangladesh Water Development Board

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Prepared & Published by:

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I would like to give thanks to all Officers and Staffs of Surface Water Processing Branch, BWDB and all of them who actively participated in preparing this report. Furthermore, I hope that this attempt will encourage Engineers of BWDB and all other users, which will be significant impact for BWDB. Finally all are requested to come up with valuable suggestions for further improvement.

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Preface

BWDB's Hydrology Division has an operational network of Hydro-Geological Stations covering Surface Water, Ground water, River Morphology and Processing & Flood Forecasting Circle. All these activities are organized by three Circles and one Directorate under Chief Engineer, Hydrology, BWDB, Dhaka. Processing and Flood Forecasting Circle, BWDB, Dhaka is one of those three circles. This circle has five divisions headed by four Executive Engineers, one Deputy Director. This circle is mandated and responsible for data validation, processing, quality control and database management. This circle has also responsible for flood forecasting and warning, data dissemination to various levels including media, historical data archiving and publishing report etc.

Surface Water Processing Branch is one of the branch/Division under Processing and Flood Forecasting Circle which receives Surface water related data from four Hydrological field offices. After getting the hard copy of data, this branch is responsible for data entry & archiving the all soft data in the data base server. Quality, validation of the data along with preparing additional secondary information for different user groups are vital responsibility of Surface Water Processing Branch. Simultaneously it has been felt to conduct research work to assess some trend analysis on the changes of Water Level of river in Bangladesh. As such this branch has taken initiative to publish a report in this context which will continue in future.

This report "Analysis of water level along the the Bramputra-Jamun, Ganga-Padma and Surma-Meghna river system" is to find out monthly highest & lowest water level in the observed station along three above major river system for the year 2014 to 2019.

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Executive summary

The principal purpose of this report is to find out variation of water level of BWDB gauge stations along with three major river system in Bangladesh from 2014 to 2019. It has been found that monthly maximum water level at noonkhawa (SW45) is 27.53 mPwd in the Brahmaputra-Jamuna river system. And in monsoon period every year maximum water level cross the danger level in this river system except in 2018 a few no of stations (Noonkhawa, Chilmari and Sirajganj) maximum water level flow slightly below the danger level in this period.

In the Ganga-Padma river system highest monthly water level observed at Pankha (SW88A) is 22.44mPwd which is 0.94m above the danger level. In this river system maximum water level of Goalundo Transit and Bhagyakul stations crosses danger level every year in this period. And also the stations Sengram, Mawa and Sureswar maximum water level flow above the danger level each year except Sengram (2015) , Mawa (2018) and Sureswar (2018) maximum water level is slightly below the danger level and rest of the stations maximum water level is above danger level and below the danger level in some years.

In the Surma-Meghna river system maximum water level at Kanairghat (SW266) is observed 14.85mPwd which is 1.65m above the danger level. In monsoon period almost all the stations i.e Kanairghat, Markuli, Azmiriganj, Madna , Austogram Satnal, Chandpur and Nilkamal maximum water level exceed danger level each year except at Sylhet (2018 & 2019), Sunamganj (2018 & 2019), Narsingdi (2018 & 2019), Badyar Bazar (2014, 2015, 2016, 2017 & 2019) and Meghna Ferry Ghat (2014 to 2018) maximum water level is below danger level in the mentioned period and at Bhairab Bazar Station maximum water level is below danger level each year in this period.

Acronyms

BWDB	Bangladesh Water Development Board
PFFC	Processing and Flood Forecasting Circle
SWPB	Surface Water Processing Branch
WL	Water Level
SW	Surface Water
MSL	Mean Sea Level

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Chapter 1

Introduction

1.1 Background

Bangladesh lies approximately between 20º 30' and 26º 40' north latitude and 88º 03' and 92º 40' east longitude. It is one of the biggest active deltas in the world with an area of about 1,47,570 sq-km. The Bay of Bengal is in the south, Myanmar borders part of the south-eastern area. It has 405 rivers including 57 trans-boundary rivers, among them 54 originated from India including three major rivers the Ganges, the Brahmaputra and the Meghna (Ref. Bangladesher Nod Nodi, BWDB, August 2011). And rest three trans-boundary rivers originated from Myanmar. Monsoon flood inundation of about 20% to 25% area of the country is assumed beneficial for crops, ecology and environment. More or less every year flood is causing direct and indirect damages and considerable inconveniences to the population. The country is mostly flat with few hills in the southeast and the northeast part. Generally ground slopes of the country extend from the north to the south and the elevation ranging from 60 meters to one meter above Mean Sea Level (MSL) from Northwest boundary of the country to the coastal areas in the south.

The country consists of the flood plains of the Ganges, the Brahmaputra and the Meghna rivers and their numerous tributaries and distributaries. The Ganges and the Brahmaputra join together at Aricha-Goalundo and is known as the Padma River. The river Meghna joining the Padma near Chandpur flows to the Bay of Bengal as named the Meghna River. Three main river system the Ganges, Brahmaputra and Meghna river systems together, drain the huge runoff generated from large area with the highest rainfall areas in the world. Most of the rivers of Bangladesh are characterized by having sandy bottoms, flat slopes, substantial meandering, banks susceptible to erosion and channel shifting.

Four Measurement divisions collect water level data every year from all around 344 nos gauge stations of more or less 127 Nos rivers all over the country. After checking, validation & other necessary works Surface Water Processing Branch sends this data into the data base server. For analyzing the water level data during the year 2014 to 2019, three major river systems (Ganga-Padma, Brahmaputro-Jamuna & Surma-Meghna) are considered for publication of the report.

1.2 Sources of Data

Bangladesh Water Development Board (BWDB) Hydrology collects, process and distributes the Hydrological Data of Bangladesh. BWDB maintains a strong hydrologic network throughout the country for the collection of different hydrological data. This network is shown below table:

Table 1. 1: Hydrological Network of BWDB

SL	Database	Type Code	Data Type Name	No of Stations
1	SW	NTWL	Non-Tidal SW Level	218
2	SW	TDWL	Tidal SW Level	126
3	SW	NTQ	Observed Discharge	111
4	SW	TDQ	Tidal Discharge	7
5	SW	SWQ	Surface Water Quality	22
6	SW	SA	Salinity	100
7	RM	CS	River Cross Section	1098
8	RM	SED	Sediment	26
9	CL	RF	Rainfall	243
10	CL	CL	Climatology	2
11	CL	EV	Evaporation	39
12	GW	GT	Weekly GW Table	1282
13	GW	GT Daily	Daily GW Table	20
14	GW	GQ	GW Quality	119

Source: BWDB Database

1.3 Used Data

- Monthly highest & lowest Water Level Data from 2014 to 2019.
- Water Level Station along the Brahmaputra-Jamuna system.
- Water Level Station along the Ganga-Padma system.
- Water Level Station along the Surma-Meghna system.

1.4 Water Level Stations

There are 344 nos Water Level Gauge Station under Surface Water Hydrology all over the Bangladesh. This report has been prepared considering main three river system (Brahmaputro-Jamuna, Ganga-Padma & Surma-Meghna) which shown on the Google map below. In Brahmaputro-Jamuna river system there are 13 nos of stations, Ganga-Padma river system there are 13 nos of stations and Surma-Meghna river system there are 18 nos of stations.

Figure 1. 1: Map showing analyzing WL Stations (Tidal & Non-tidal).

List of Hydrological Station along Brahmaputra-Jamuna river system:

In this river system there are 13 nos of water level stations. The station Kamarjani (SW46) and Porabari (SW50) don't have sufficient Water level data for the period of 2014 to 2019. For this we did not consider these two station for analysis. The rest of 11 nos water level stations are listed below.

Sl. No.	River Name	Station ID	Station Name	Danger Level (mPWD)
1	Brahmaputra-Jamuna	SW15J	Mathurpara-Milanpur	nill
2	Brahmaputra-Jamuna	SW45	Noonkhawa	26.50
3	Brahmaputra-Jamuna	SW45.5	Chilmari	23.70
4	Brahmaputra-Jamuna	SW46.7L	Kholabarichar	nill
5	Brahmaputra-Jamuna	SW46.9R	Fulchari_Transit	19.50
6	Brahmaputra-Jamuna	SW46.9L	Bahadurabad_Transit	19.50
7	Brahmaputra-Jamuna	SW48	Jaganathganj	14.02
8	Brahmaputra-Jamuna	SW49A	Kazipur	15.24
9	Brahmaputra-Jamuna	SW49	Sirajganj	13.35
10	Brahmaputra-Jamuna	SW50.3	Mathura	10.06
11	Brahmaputra-Jamuna	SW50.6	Aricha	9.40

Table 1. 2: List of Water Level Station of Brahmaputra-Jamuna river system

List of Hydrological Station along Ganga-Padma river flow line:

In this river system there are 13 nos of water level gauge stations. The station Taspasa (SW94) don't have sufficient Water level data for the period of 2014 to 2019. For this we did not consider the station for analysis. The rest of 12 nos water level stations are listed below.

Sl. No.	River Name	Station ID	Station Name	Danger Level (mPWD)
1	Ganges-Padma	SW88A	Panka	21.50
2	Ganges-Padma	SW88	Rajshahi	18.50
3	Ganges-Padma	SW89	Sardah	17.62
4	Ganges-Padma	SW90	Hardinge Bridge	14.25
5	Ganges-Padma	SW91	Talbaria	12.80
6	Ganges-Padma	SW91.1	Sengram	10.97
7	Ganges-Padma	SW91.2	Mohendrapur	10.80
8	Ganges-Padma	SW91.9R	Goalundo Transi	8.50
9	Ganges-Padma	SW91.9L	Baruria Transit	8.50
10	Ganges-Padma	SW93.4L	Bhagyakul	6.00
11	Ganges-Padma	SW93.5L	Mawa	6.00
12	Ganges-Padma	SW95	Sureswar	4.42

Table 1. 3: List of Water Level Station of Ganga-Padma river system

List of Hydrological Station along Surma-Meghna river System:

In this river system there are 18 nos of water level stations. The station Chatak (SW268), Dirai_on Kalni (SW269.5), Ibrahimpur (SW277.1R) and Daulatkhan (SW278) don't have sufficient Water level data for the period of 2014 to 2019. For this we did not consider these four stations for analysis. The rest of 14 nos water level stations are listed below.

Sl. No.	River Name	Station ID	Station Name	Danger Level (mPWD)
1	Surma-Meghna	SW266	Kanairghat	13.20
2	Surma-Meghna	SW267	Sylhet	11.25
3	Surma-Meghna	SW269	Sunamganj	8.25
4	Surma-Meghna	SW270	Markuli	5.79
5	Surma-Meghna	SW271	Azmiriganj	5.49
6	Surma-Meghna	SW272	Madna	5.18
7	Surma-Meghna	SW272.1	Austogram	5.18
8	Surma-Meghna	SW273	Bhairab Bazar	6.25
9	Surma-Meghna	SW274	Narsingdi	5.18
10	Surma-Meghna	SW275	Badyar Bazar	5.18
11	Surma-Meghna	SW275.5	Meghna Ferry Ghat	5.03
12	Surma-Meghna	SW276	Satnal	nill
13	Surma-Meghna	SW277	Chandpur	4.00
14	Surma-Meghna	SW277.3	Nilkamal	3.81

Table 1. 4: List of Water Level Station of Surma-Meghna_river system

Chapter 2
River System of Bangladesh

2.1 River flow of Bangladesh

Bangladesh is the second largest deltaic flood plain of the world. It is one of the biggest active deltas in the world with an area of about 1,47,570 sq-km. There are more than 405 nos different types of river flow all over the country of the three major river systems- Ganges-Padma, the Brahmaputra-Jamuna and Upper & Lower Meghna are significant.

The country is mostly flat with few hills in the southeast and the northeast part. Generally ground slopes of the country extend from the north to the south and the elevation ranging from 60 meters to one meter above Mean Sea Level (MSL) at the Northwest boundary of the country and at the coastal areas in the south.

The country consists of the flood plains of the Ganges, the Brahmaputra and the Meghna rivers and their numerous tributaries and distributaries. The Ganges and the Brahmaputra join together at Aricha-Goalundo and is known as the Padma River. The river Meghna joining the Padma near Chandpur flows to the Bay of Bengal as the Meghna River. Three main river systems the Brahmaputra-Jamuna, Ganges and Meghna river systems together drain the huge runoff generated from large area with the highest rainfall areas in the world.

Their total catchment area is approximately 1.6 million sq-km of which only about 7.5% lies in Bangladesh and the rest, 92.5% lies outside the territory. It is assumed that an average flow of 1,009,000 Million cubic meters flowing through these river systems during the monsoon season. The river system of Bangladesh is one of the most extensive in the world and the Ganges and the Brahmaputra are amongst the largest rivers on earth in terms of catchment size, river length and discharge.

In Bangladesh 80 percent of the total river flow occurs during July to October. Consequentially, there is too much water in monsoon season. On contrary, the rest of the 20 percent flow occurs in dry season which is too petite. As a result, there is usually a scarcity of water during January to March. Moreover, we have little influence over our transboundary rivers.

A sample River map of Bangladesh is shown below:

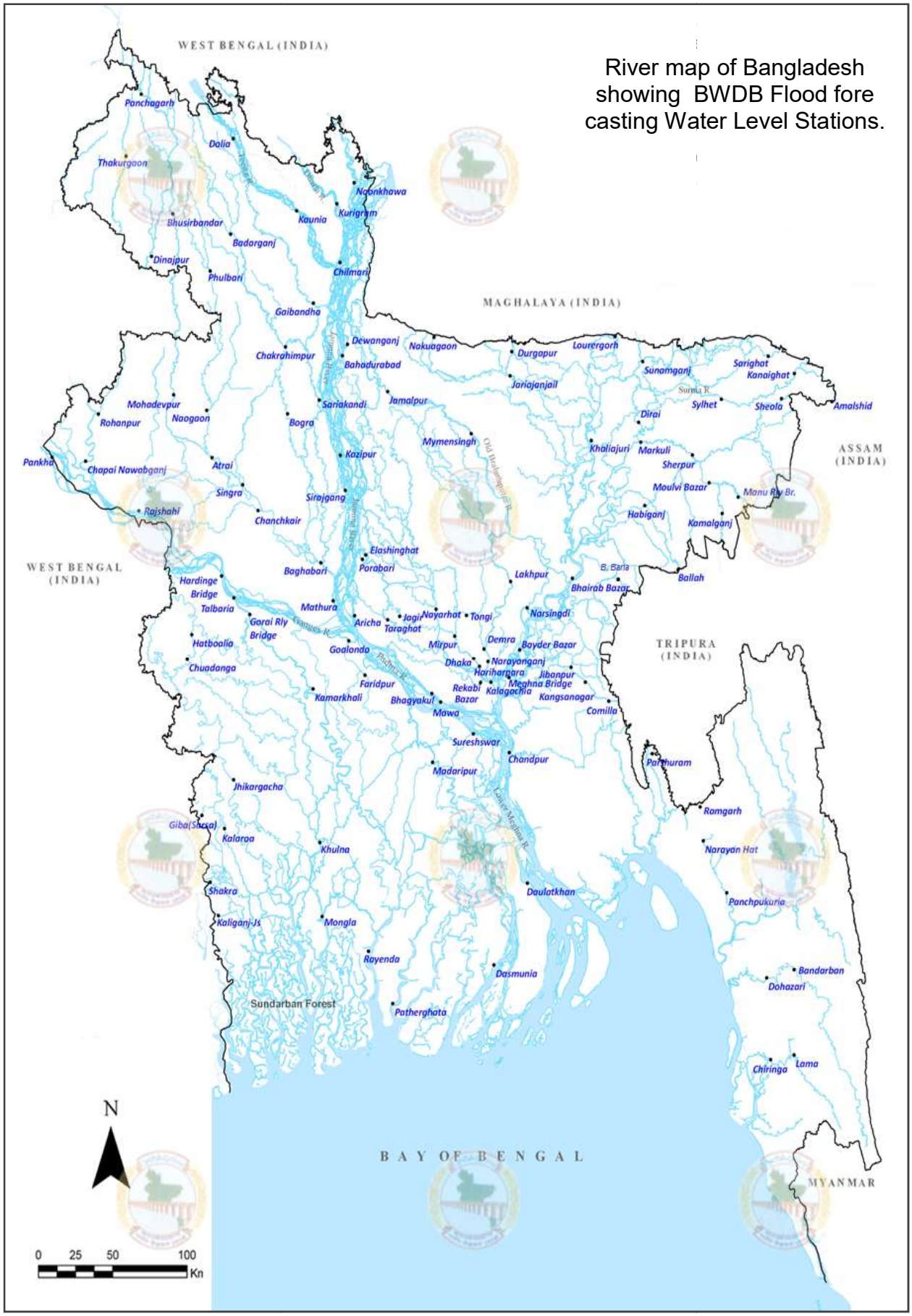

Figure 2. 1: River map of Bangladesh showing BWDB Flood fore casting Water Level Stations.

2.2 Statistics of three major river System of Bangladesh

The Brahmaputra-Jamuna, Ganges and Meghna rivers drain a catchment of about 1.72million sq. km. This is about 12 times the surface area of Bangladesh. Most of the water resources of Bangladesh are received from upstream countries through 57 trans-boundary rivers.

The Brahmaputra river is one of the largest river of South Asia in terms of annual discharge. Average discharge of the Brahmaputra is approximately 20,000m^3/s (Immerzeel, 2008) and a specific flood discharge of 0.149 m^3/s/km2 (Datta and Singh 2004). It is 640 km long and the width varies from 64 km to 90 km (Datta and Singh 2004). The Brahmaputra River drains an area of around 580,000km^2, covering four countries China (50.5%), India (33.6%), Bangladesh (8.1%) and Bhutan (7.8%)(Singh et al 2004). Brahmaputra river travels a total distance of 2,880km (1,625km in China, 918km in India and 337km in Bangladesh) finally falls into the Bay of Bengal through a joint channel with the Ganga (Ganges River). In Bangladesh, the Brahmaputra splits into two branches named as Jamuna, flows into the Padma, while the other branch named as the old Brahmaputra, flows into the Upper Meghna. Both flows eventually met near Chandpur in Bangladesh and flow out into the Bay of Bengal.

Total length of the Ganges River is about 2,600 km to its confluence with the Brahmaputra -Jamuna at Aricha-Goalondo and a catchment area of approximately 9,07,000 sq-km. Started from the high western Himalayans glaciers, the Ganges has a short mountain course of about 160 km. From there it flows south easterly in a vast plain with major tributaries from the southern Himalayans in Nepal and smaller rivers from the central Indian Plateau to the south. With deep-water channel with numerous bar formations (chars), the Ganges is not braided. After its confluence with the Jamuna at Goalondo, the river, known as the Padma, flows in a wide and straight.

The Meghna system originates in the hills of Shillong and Meghalaya of India. The main source is the Barak River, which has a considerable catchment in the ridge and valley terrain of eastern Assam bordering Myanmar. On reaching the border with Bangladesh at Amalshid in Sylhet district, it bifurcates into Surma and the Kushiyara rivers. The Surma, flowing on the north of the Sylhet basin receives Right Bank tributaries from Khasia and Jaintia Hills of Shillong. These are steep, highly flashy

rivers, originating in one of the wettest area of the world. The Kushiyara receives left bank tributaries from the Tripura Hills, the principal ones being the Manu. Also, flashy in nature with less elevations and rainfall of Tripura makes these rivers less violent than the northern streams. Between the Surma and Kushiyara, there are many internal draining depressions (haors), meandering flood channels and abandoned river courses, which are widely flooded every monsoon season. The two rivers rejoined at Markuli and flow via Bhairab as the Meghna. At Chandpur, the Padma and the Meghna joined together from where it flows to the sea with tidal influence.

2.3 River Water flow :

The confluence of three major rivers, the Ganges, the Brahmaputra and the Meghna: the runoff from their vast catchment (about 1.72 million km²) passes through a small area, only 8% of these catchments lie within Bangladesh. During the monsoon season the amount of water entering Bangladesh from upstream is greater than the capacity of the rivers to discharge into the sea. Bangladesh is a land of rivers: there are about 405 major and minor rivers in the country. The total annual runoff of surface water flowing through the rivers of Bangladesh is about 12,000 billion cubic meters (BWDB FFWC flood report), which are more than capacity of the flood plains to store water. Up-stream hilly catchments cause more rapid and higher runoff, and hence more intense flooding. The spring tides of the Bay of Bengal retard the drainage of floodwater into the sea and locally increase monsoon flooding. BWDB observed flood situation along three major river system.

Chapter 3
Findings and Discussions

3.1 Analysis of Water Level

Here we analysis monthly maximum and minimum water level of three major river system for the period of 2014 to 2019 which are shown in the graph below:

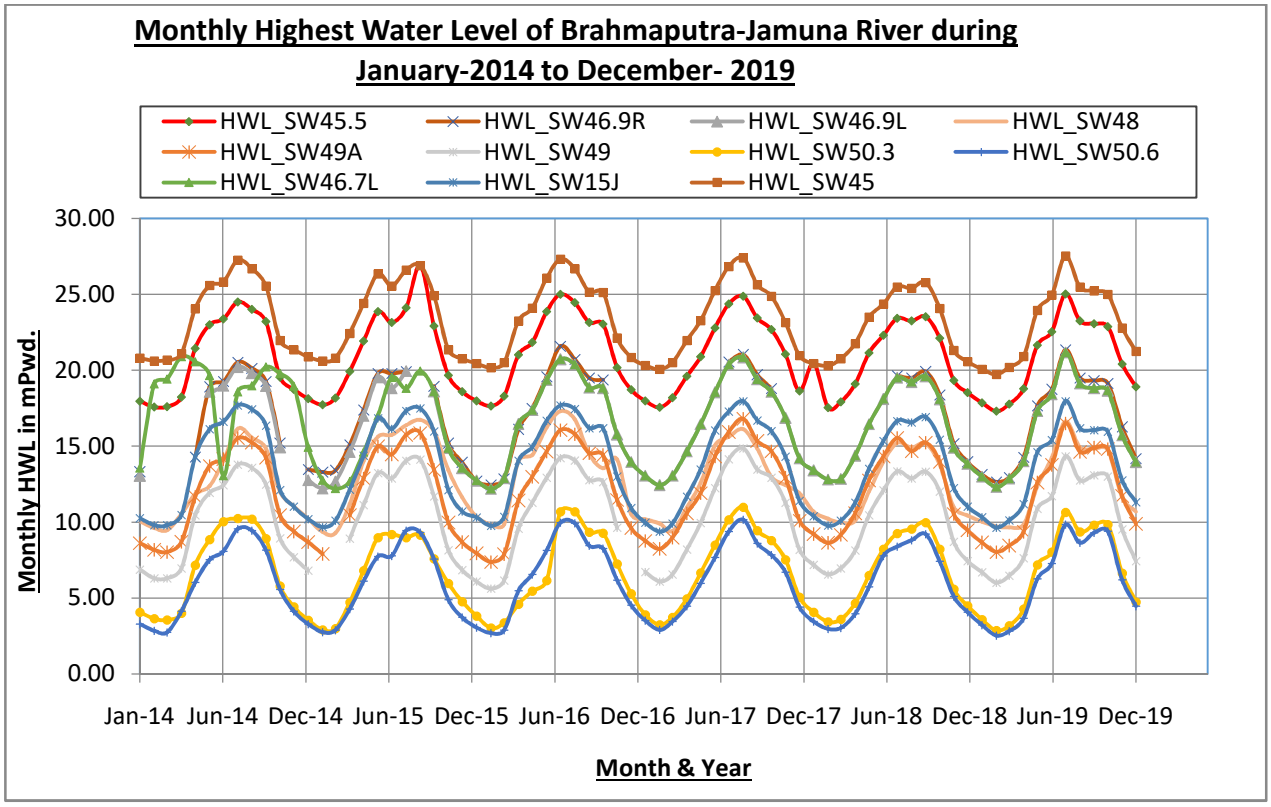

Figure 3. 1: Monthly Highest Water Level of Brahmaputra-Jamuna river system

In the Brahmaputra-Jamuna river system during this 6 years period at noonkhawa (SW45) maximum water level observed 27.53 mPwd in July/2019, which was 1.03 m above danger level. At the same time, it is found that maximum water level at Mathurpara-Milanpur (SW15j, nill) station was 17.97m, at Chilmari (SW45.5, 23.7m) station was 26.89m, at Kholabarichar (SW46.7L, nill) station was 21.16m, at Fulchari Transit (SW46.9R,19.50m) station was 21.59m, at Bahadurabad transit (SW46.9L, 19.50m) station was 21.16m, at Jananathganj (SW48,14.02m) station was 17.30m, at Kazipur (SW49A, 15.24m) station was 16.80m, at Sirajganj (SW49,13.5m) station was 14.87m, at Mathura (SW50.3, 10.06m) station was 10.99m, at Aricha (SW50.6, 9.40m) station was 10.16m.

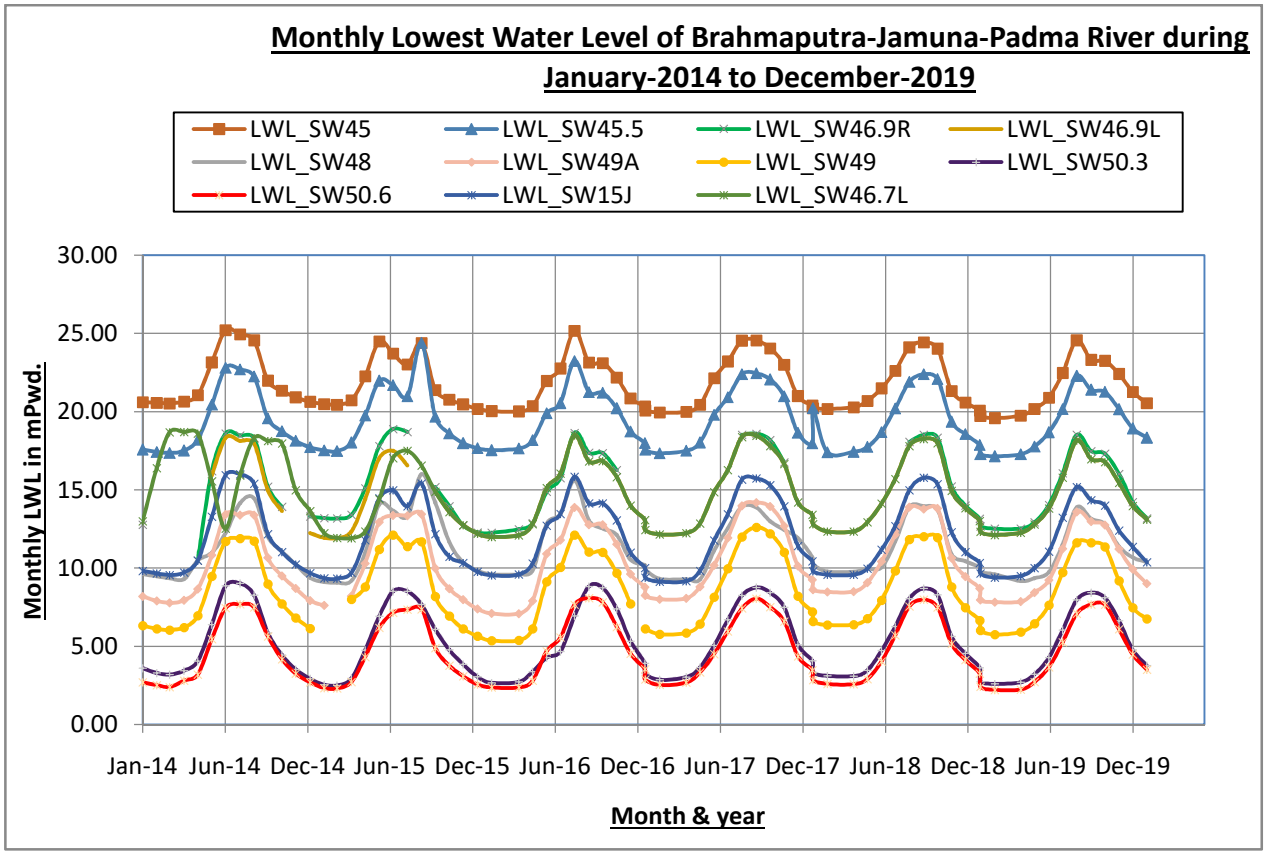

Figure 3. 2: Monthly Lowest Water Level of Brahmaputra-Jamuna river system

And at the same time lowest water level found during this 6 years period at noonkhawa station (SW45) was 19.58m, at Mathurpara-Milanpur (SW15j) station was 9.13m, at Chilmari (SW45.5) station was 17.14m, at Kholabarichar (SW46.7L) station was 11.91m, at Fulchari Transit (SW46.9R) station was 10.47m, at Bahadurabad transit (SW46.9L) station was 11.91m, at Jananathganj (SW48) station was 9.07m,at Kazipur (SW49A) station was 7.09m, at Sirajganj (SW49) station was 5.37m, at Mathura (SW50.3) station was 2.50m, at Aricha (SW50.6) station was 2.22m.

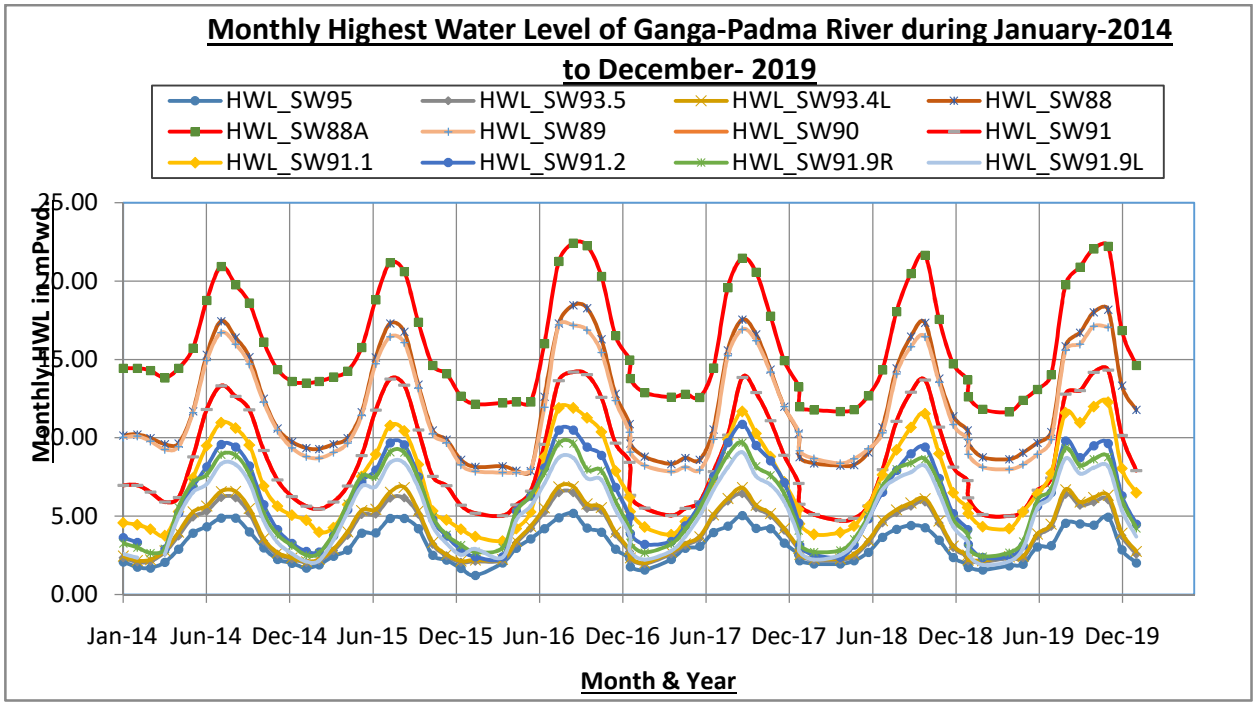

Figure 3. 3: Monthly Highest Water Level of Ganga-Padma river system

In the Ganga-Padma river system maximum water level found at Pankha (SW88A, 21.50m) station was 22.44m, which is 0.94m above the danger level. At the same time maximum water level at Rajshahi (SW88, 18.50m) station was 18.46m, at Sardah SW89, 17.62m) station was 17.20m, at Hardinge Bridge (SW90, 14.25m) station was 14.33m, at Talbaria (SW91, 12.80m) station was 13.43m , at Sengram (SW91.1, 10.97m) station was 12.28m , at Mohendrapur (SW91.2, 10.80m) station was10.86m, at Goalando Transit (SW91.9R, 8.50m) station was 9.71m, at Baruria Transit (SW91.9L, 8.50m) station was 9.08m, at Bhagyakul (SW93.4L, 6.00m) station was 6.90m, at Mawa (SW93.5L, 6.00m) station was 6.50m and at Sureswar (SW95, 4.42m) station was 5.18m.

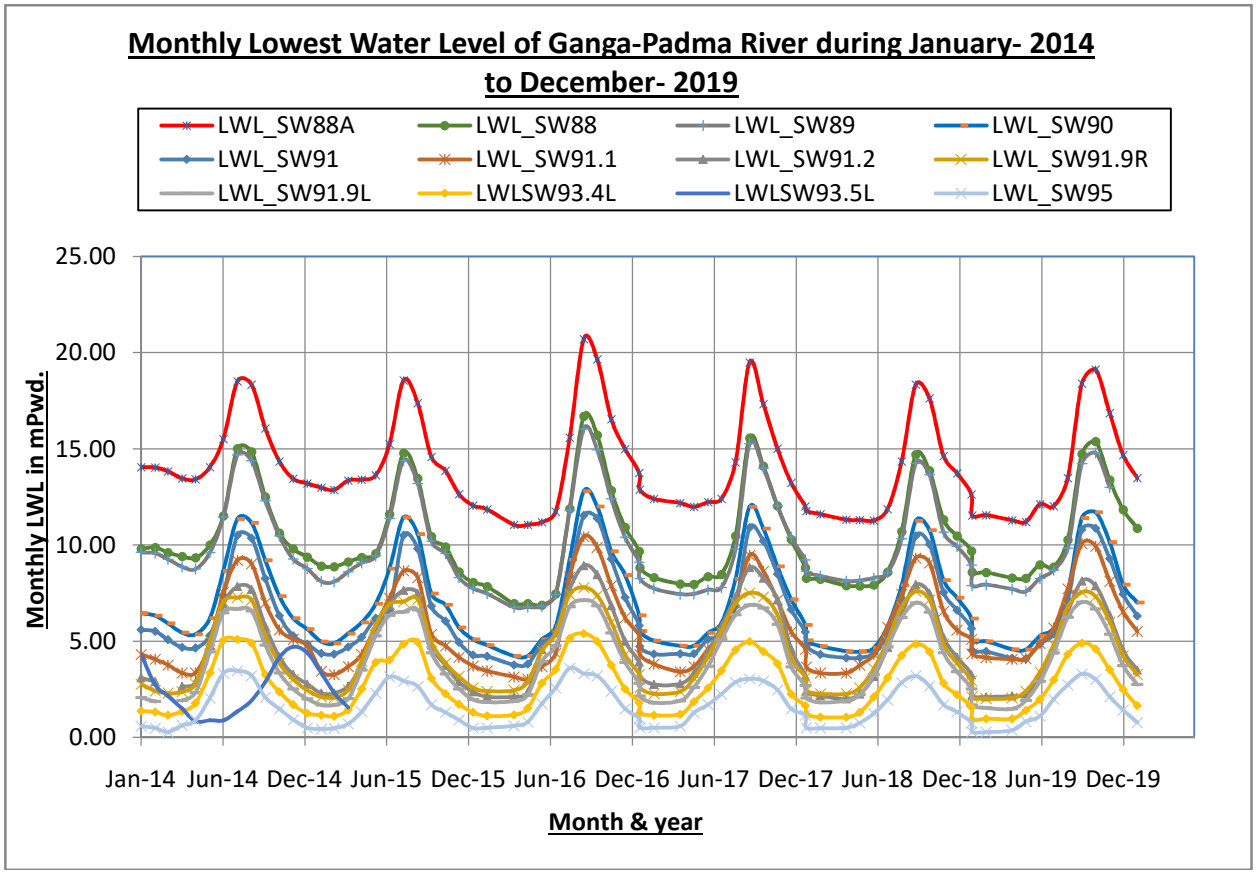

Figure 3. 4: Monthly Lowest Water Level of Ganga-Padma river system

At the same time minimum water level in Ganga-Padma river system found at Pankha (SW88A) station was 11.05m, at Rajshahi (SW88) station was 6.87m, at Sardah (SW89) station was 6.76m, at Hardinge Bridge (SW90) station was 4.23m, at Talbaria (SW91) station was 3.77m , at Sengram (SW91.1) station was 3.01m , at Mohendrapur (SW91.2) station was 2.00m, at Goalando Transit (SW91.9R) station was 2.01m, at Baruria Transit (SW91.9L) station was 1.48m, at Bhagyakul (SW93.4L) station was 0.92m, at Mawa (SW93.5L) station was 0.84m and at Sureswar (SW95) station was 0.26m.

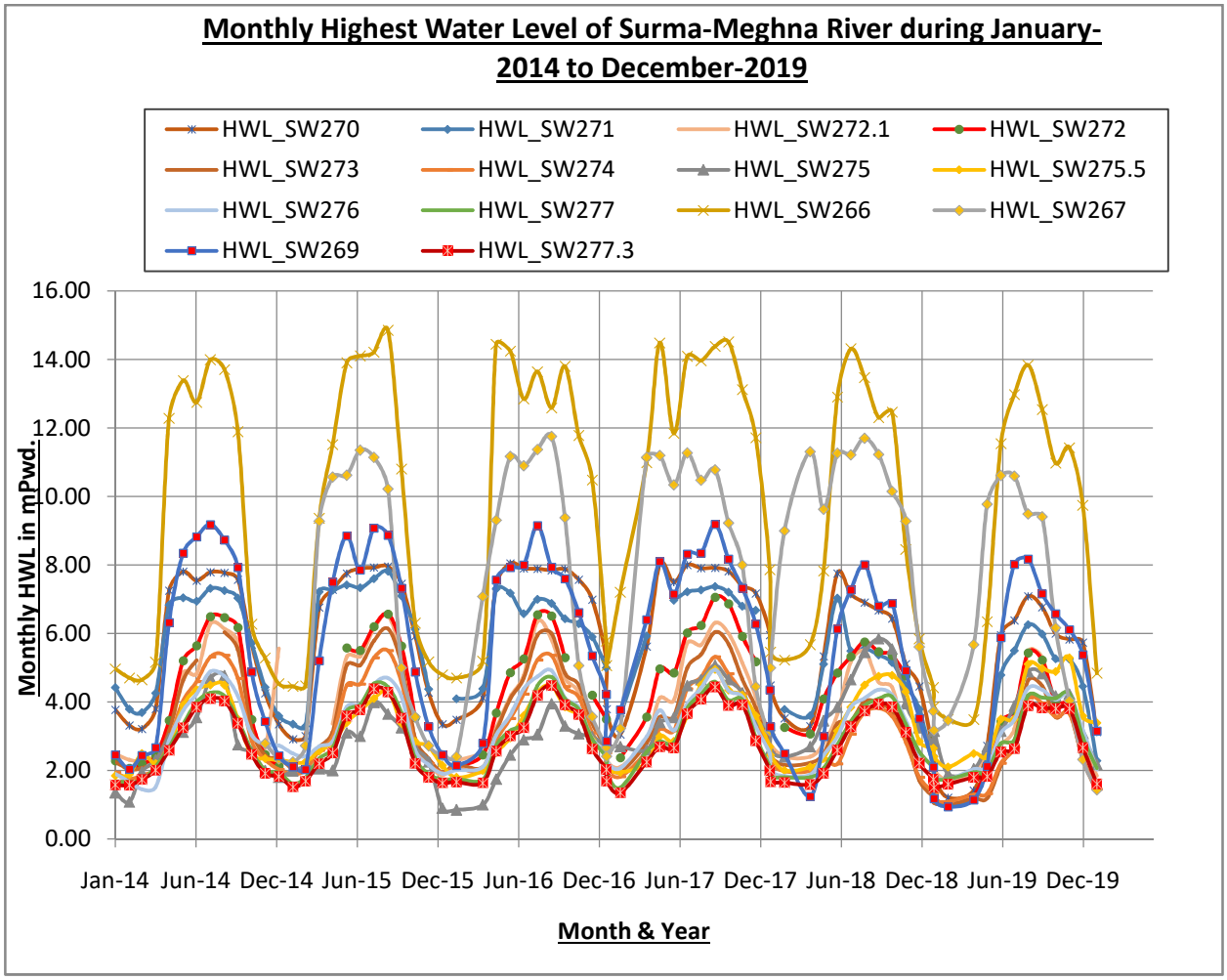

Figure 3. 5: Monthly Highest Water Level of Surma-Meghna river system

In the Surma-Meghna river system maximum water level found at Kanairghat (SW266, 13.20m) station was 14.85m which is 1.65m above the danger level, at Sylhet (SW267, 11.25m) station was 11.76m, at Sunamganj (SW269, 8.25m) station was 9.19m, at Markuli (SW270, 5.79m) station was 8.05m, at Azmiriganj (SW271, 5.49m) station was 7.82m, at Madna (SW272, 5.18m) station was 7.06m, at Austogram (SW272.1, 5.18m) was 6.53m, at Bhairab Bazar (SW273, 6.25m) station was 6.14m, at Narsingdi (SW274, 5.18m) station was 5.50m, at Badyar Bazar (SW275, 5.18m) station was 5.85m, at Meghna Ferry Ghat (SW275.5, 5.03m) station was 5.29 m, at Satnal (SW276, nill) station was 4.94m, at Chandpur (SW277, 4.00m) station was 4.73m, at Nilkamal (SW277.3, 3.81m) station was 4.48m.

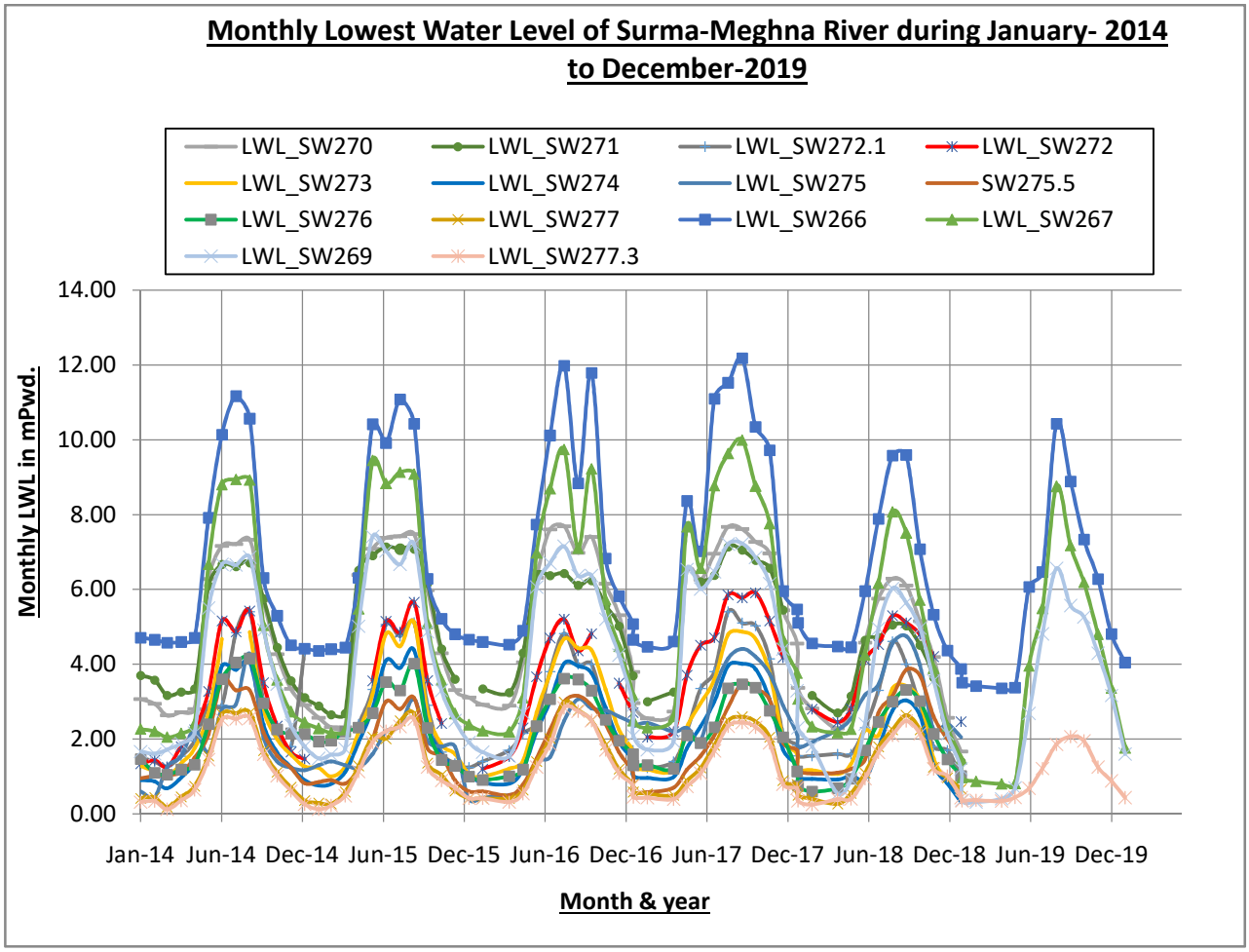

Figure 3. 6: Monthly Lowest Water Level of Surma-Meghna river system

At the same time minimum water level found in the Surma-Meghna river system at Kanairghat (SW266) station was 3.36m, at Sylhet (SW267) station was 0.80m, at Sunamganj (SW269) station was 0.32m, at Markuli (SW270) station was 0.71m, at Azmiriganj (SW271) station was 0.52m, at Madna (SW272) station was 0.73m, at Austogram (SW272.1) was 0.87m, at Bhairab Bazar (SW273) station was -0.11m, at Narsingdi (SW274) station was -0.17m, at Badyar Bazar (SW275) station was 0.40m, at Meghna Ferry Ghat (SW275.5) station was 0.50m, at Satnal (SW276) station was 0.41m, at Chandpur (SW277) station was 0.18m, at Nilkamal (SW277.3) station was 0.12m.

There are total 37 nos of stations in this three major river system. Of them 3 nos stations don't have predefine danger level. Here we also tried to compare between yearly highest water level with danger level which is shown in appendix-1.

3.2 Conclusion

Monthly maximum & minimum water level data during the year 2014 to 2019 of three major river system of Bangladesh has been summarized in this report. The monthly maximum & minimum water level during 2014 to 2019 have been analysed from BWDB recorded data during this period. In Brahmaputra-Jamuna river system we analysed total 11 nos gauge stations. In this river system station only Mathurpara-Milanpur and Kholabarichar don't have predefine danger level. After analysing we saw that all most all the gauge station maximum water level crossed above the danger level in this period.

In the Ganga-Padma river system all stations have predefine danger level and most of the gauge stations maximum water level cross the danger level except Rajshai (SW88) and Sardah (SW89). Rajshahi (SW88) and Sardah (SW89) maximum water level don't cross the danger level during this time, which are 0.040m and 0.42m below the danger level.

In the Surma-Meghna river system Mathurpara-Milanpur (SW15J) and Kholabarichar (SW46.7L) don't have predefine danger level and rest of 9 gauge stations maximum water level cross the danger level in this period.

Appendix-1

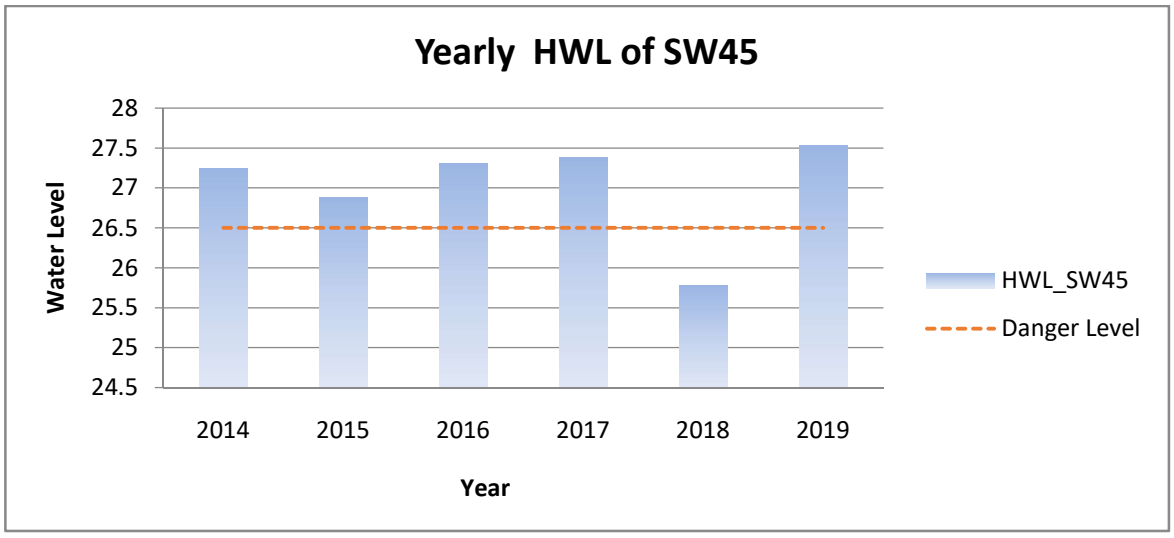

Figure: Yearly Highest Water Level VS danger Level (SW45)

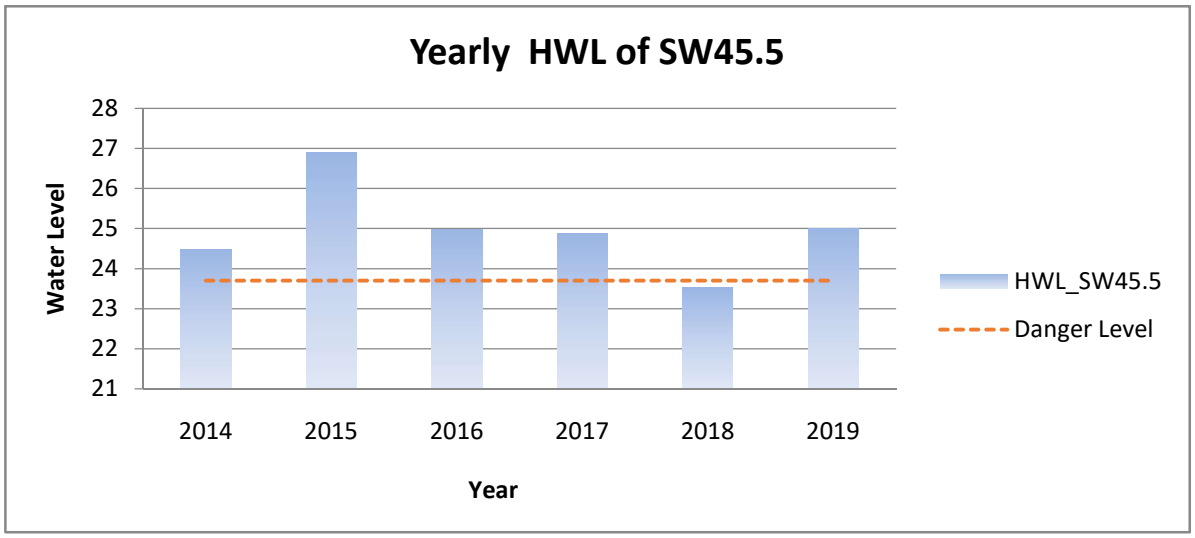

Figure: Yearly Highest Water Level VS danger Level (SW45.5)

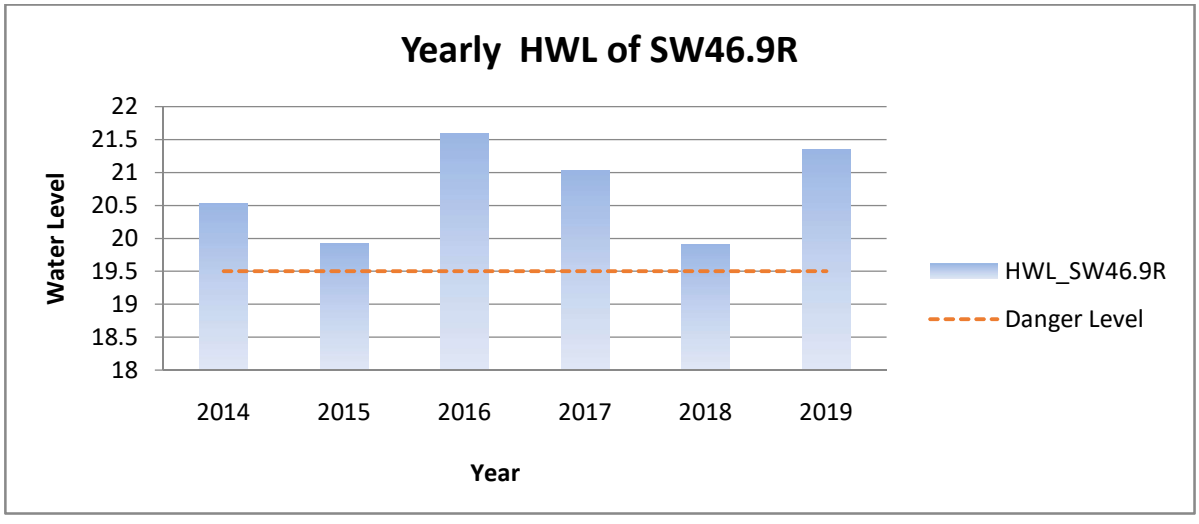

Figure: Yearly Highest Water Level VS danger Level (SW46.9R)

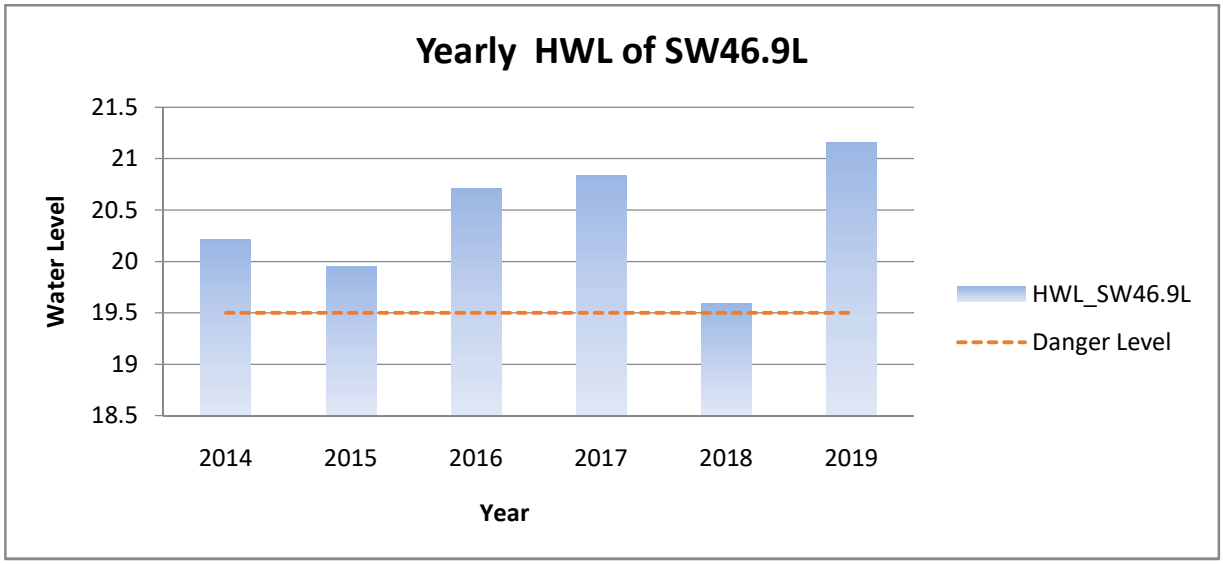

Figure: Yearly Highest Water Level VS danger Level (SW46.9L)

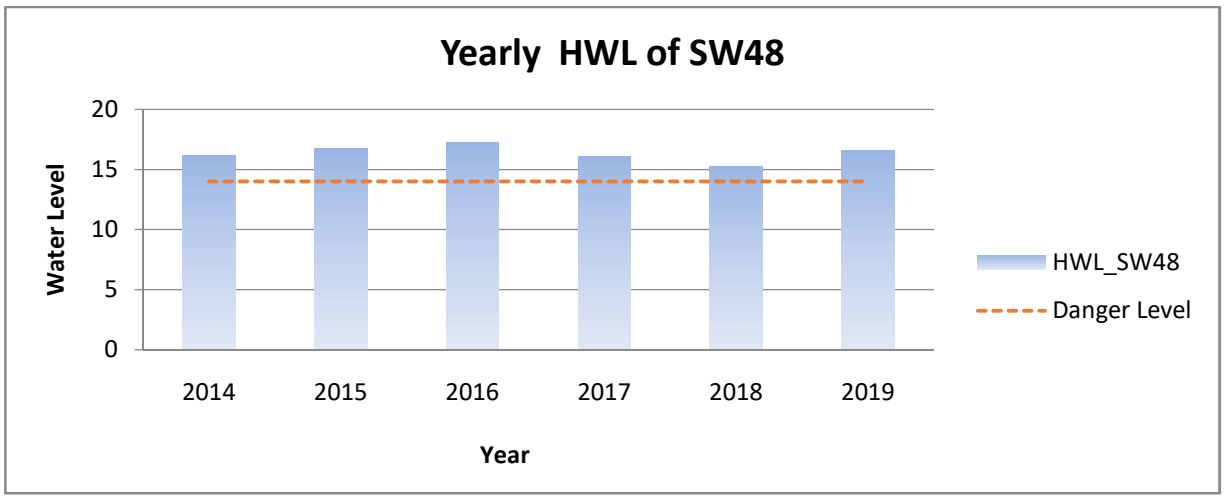

Figure: Yearly Highest Water Level VS danger Level (SW48)

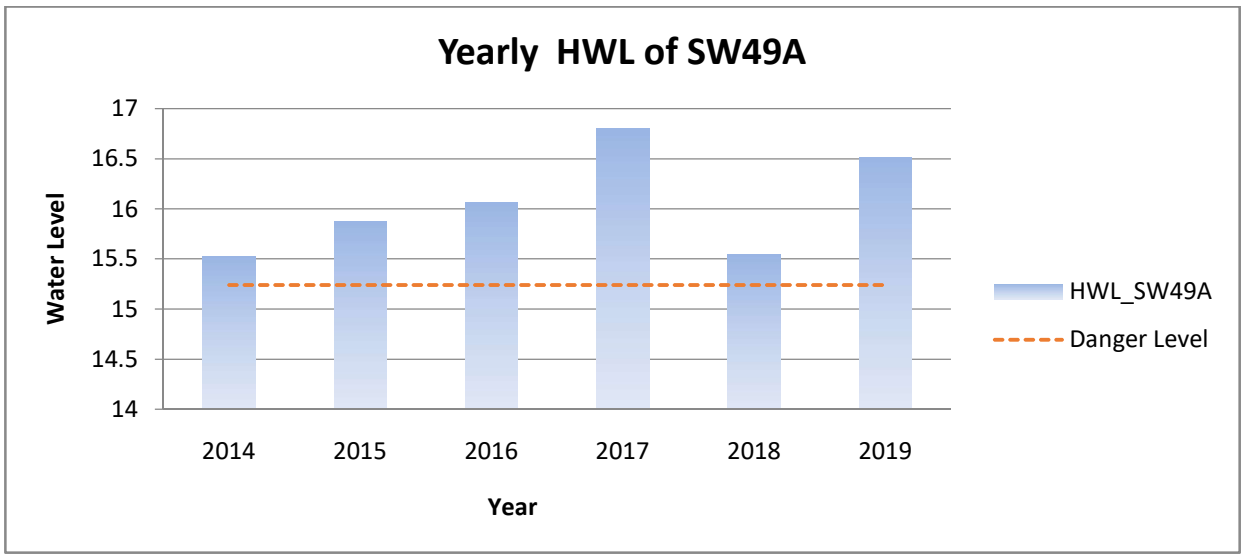

Figure: Yearly Highest Water Level VS danger Level (SW49A)

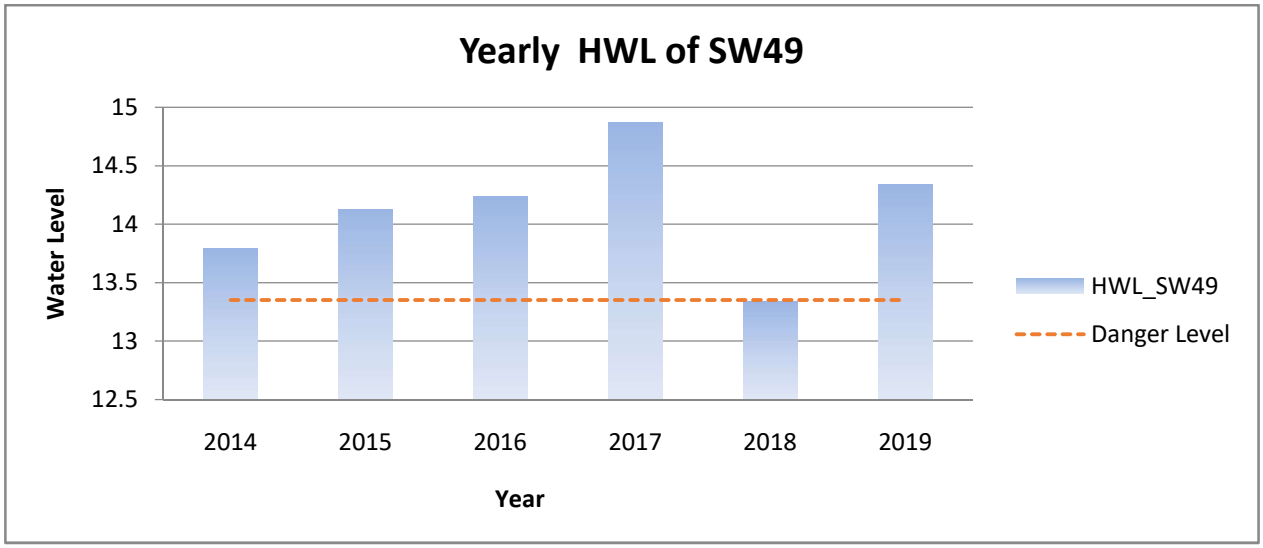

Figure: Yearly Highest Water Level VS danger Level (SW49)

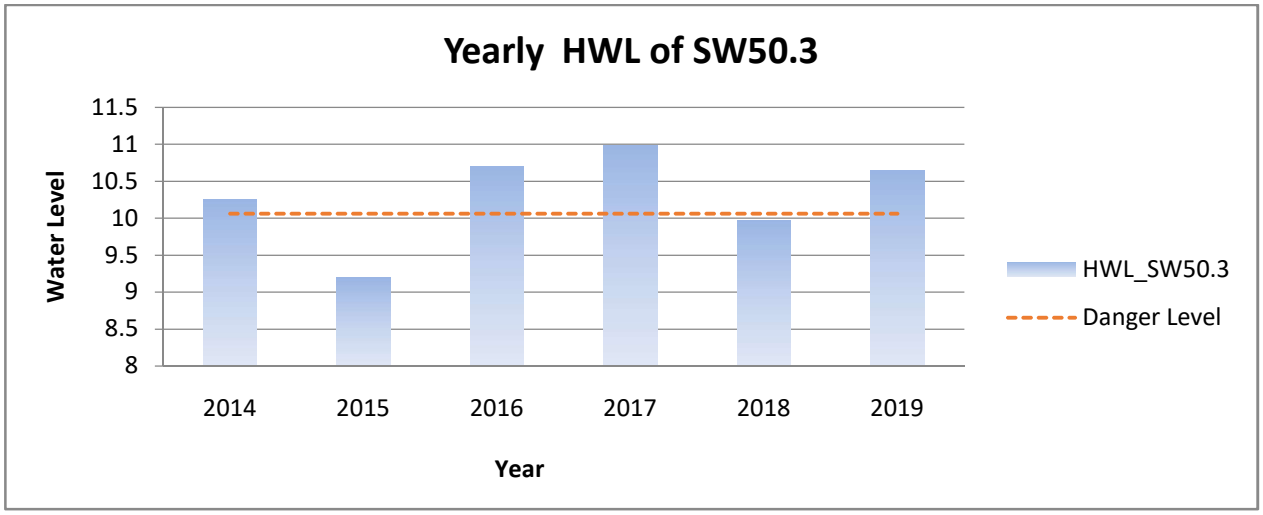

Figure: Yearly Highest Water Level VS danger Level (SW50.3)

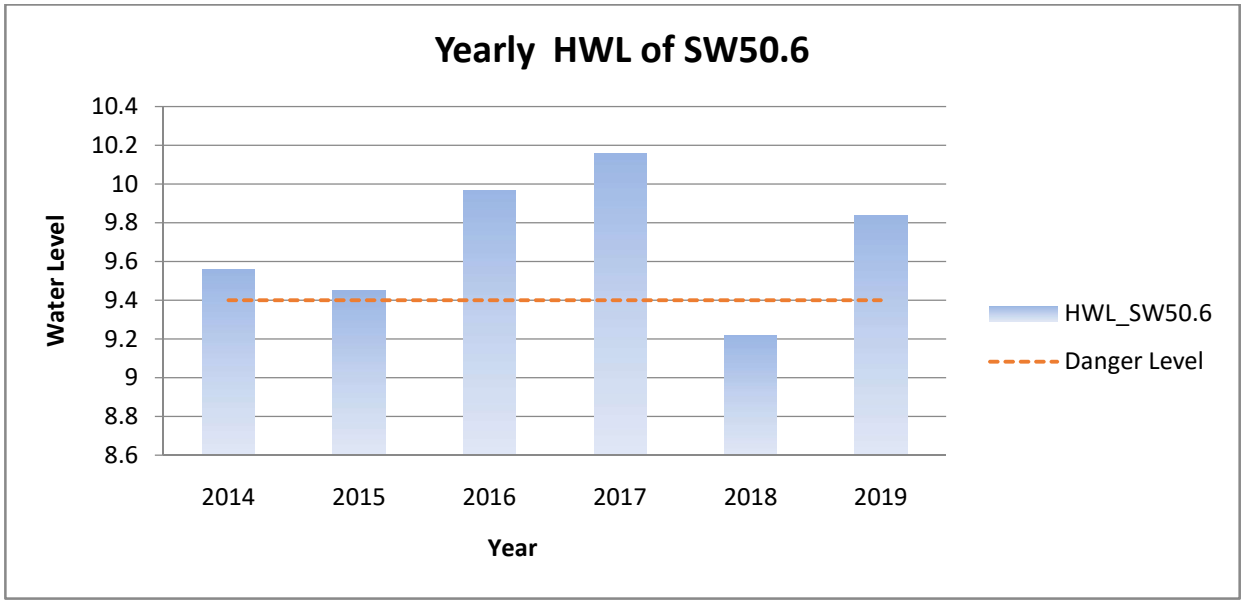

Figure: Yearly Highest Water Level VS danger Level (SW50.6)

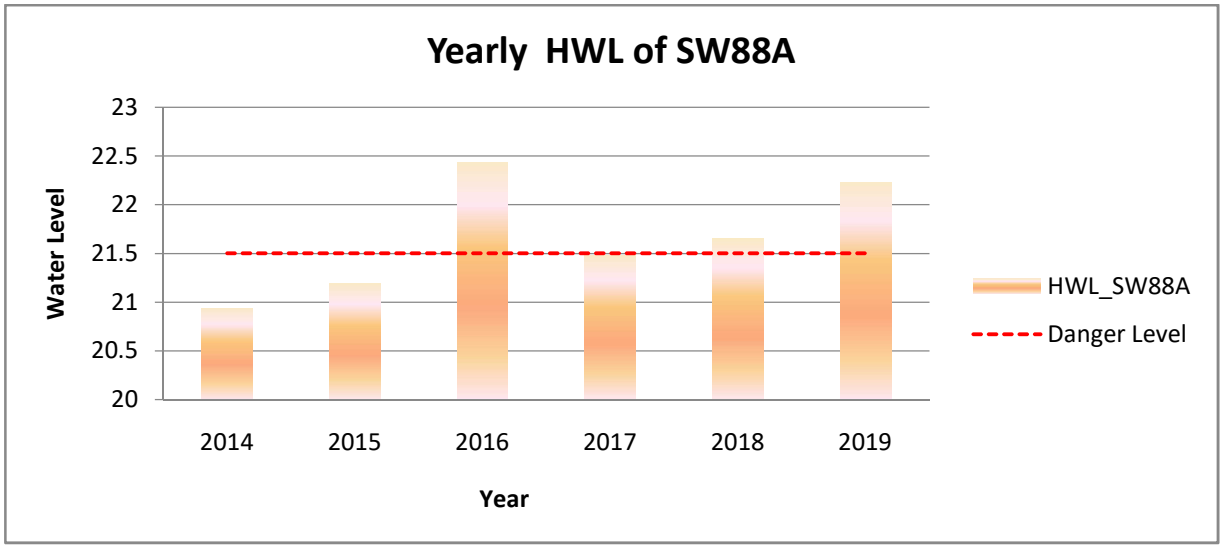

Figure: Yearly Highest Water Level VS danger Level (SW88A)

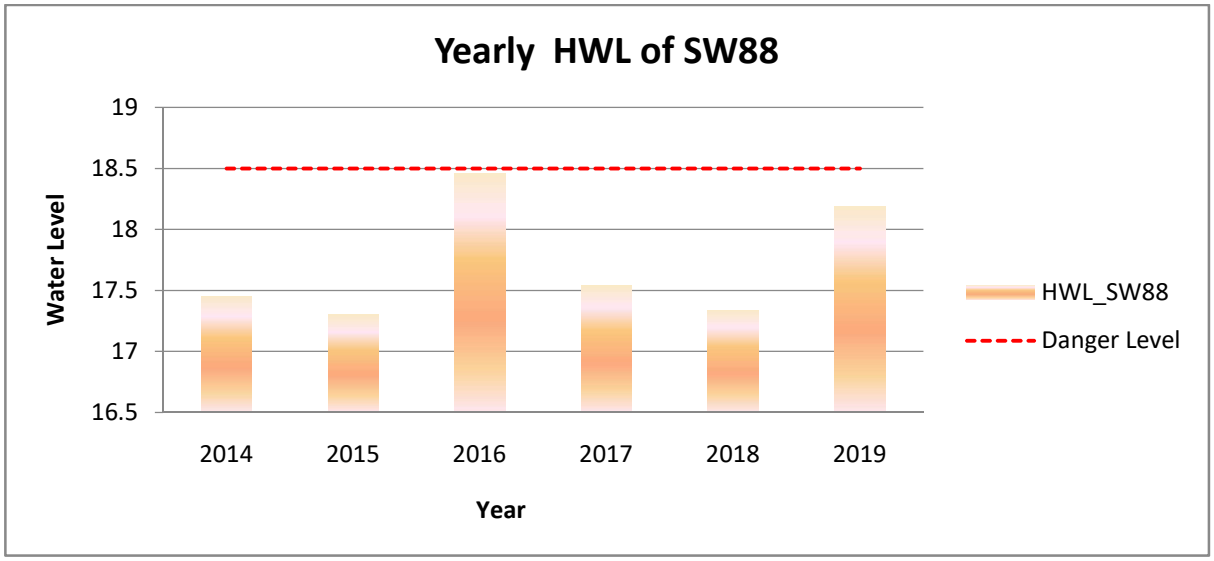

Figure: Yearly Highest Water Level VS danger Level (SW88)

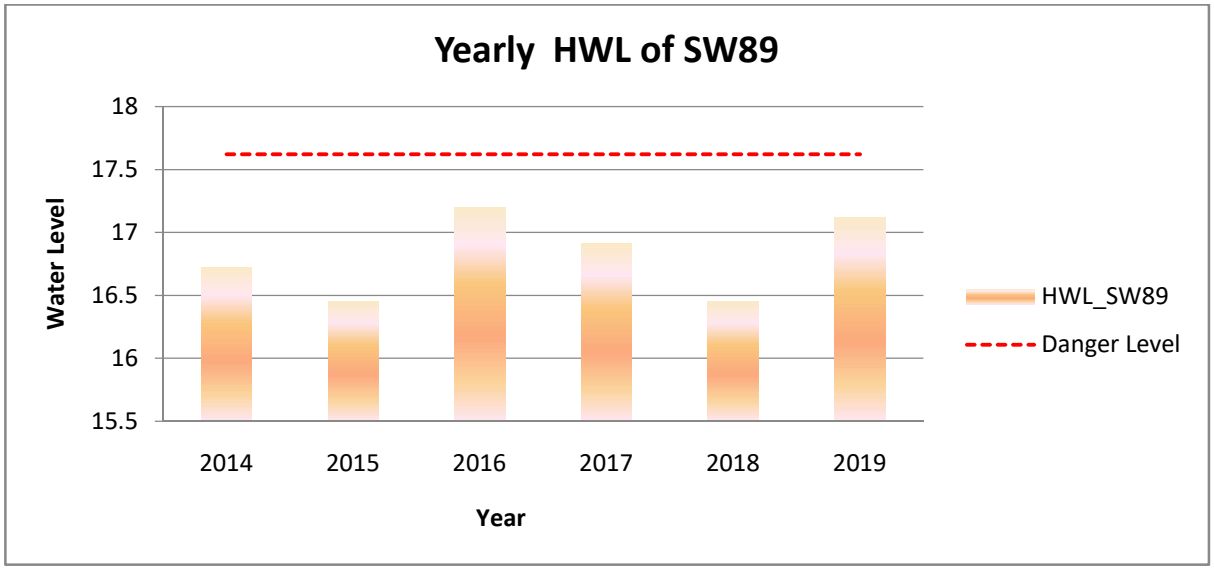

Figure: Yearly Highest Water Level VS danger Level (SW89)

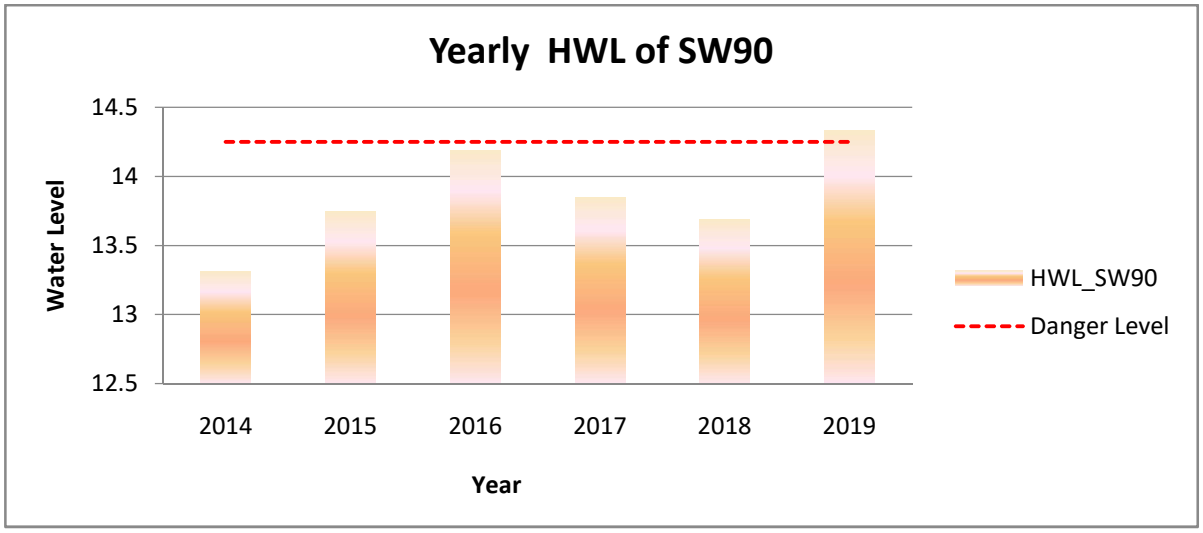

Figure: Yearly Highest Water Level VS danger Level (SW90)

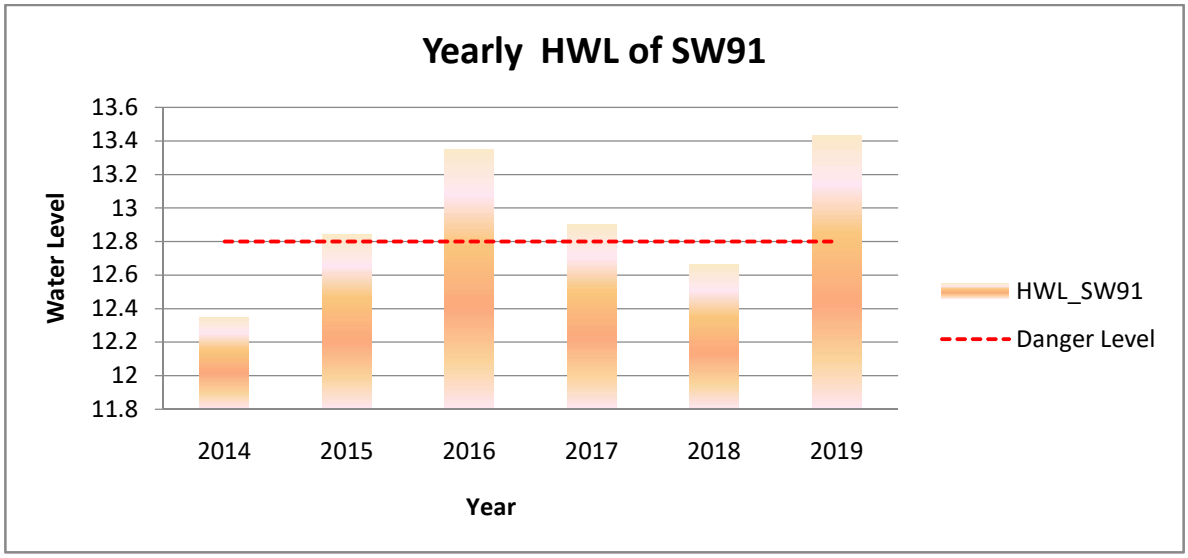

Figure: Yearly Highest Water Level VS danger Level (SW91)

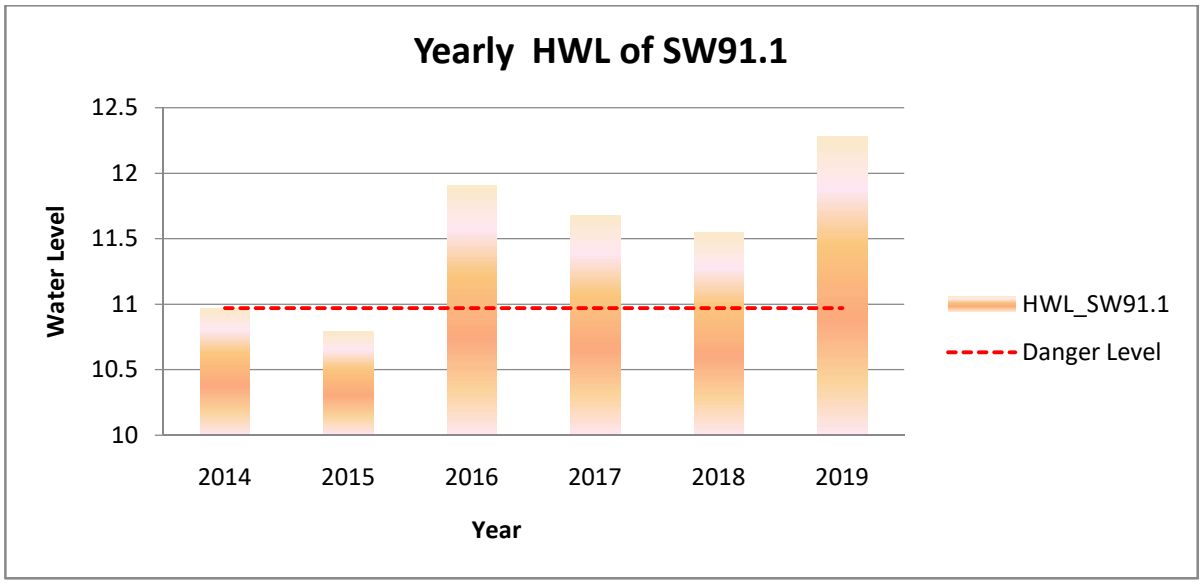

Figure: Yearly Highest Water Level VS danger Level (SW91.1)

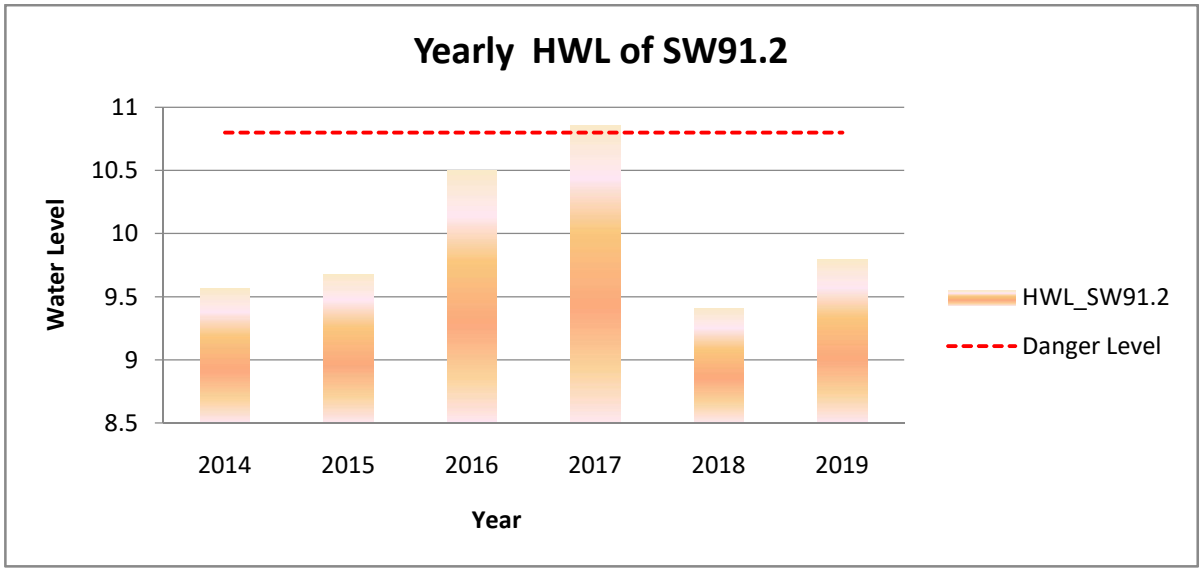

Figure: Yearly Highest Water Level VS danger Level (SW91.2)

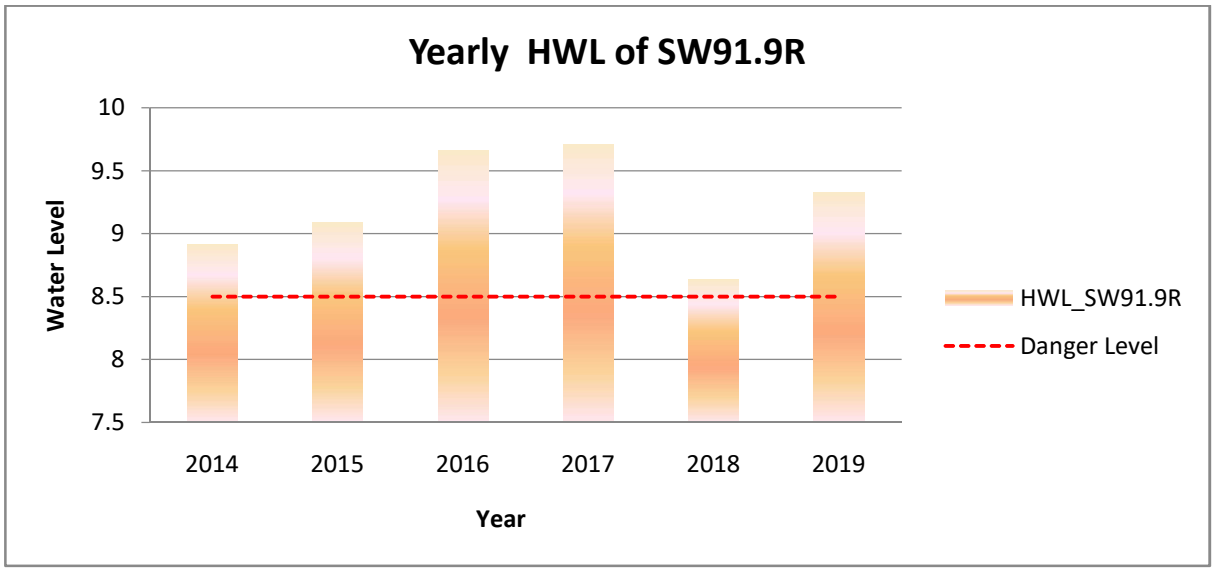

Figure: Yearly Highest Water Level VS danger Level (SW91.9R)

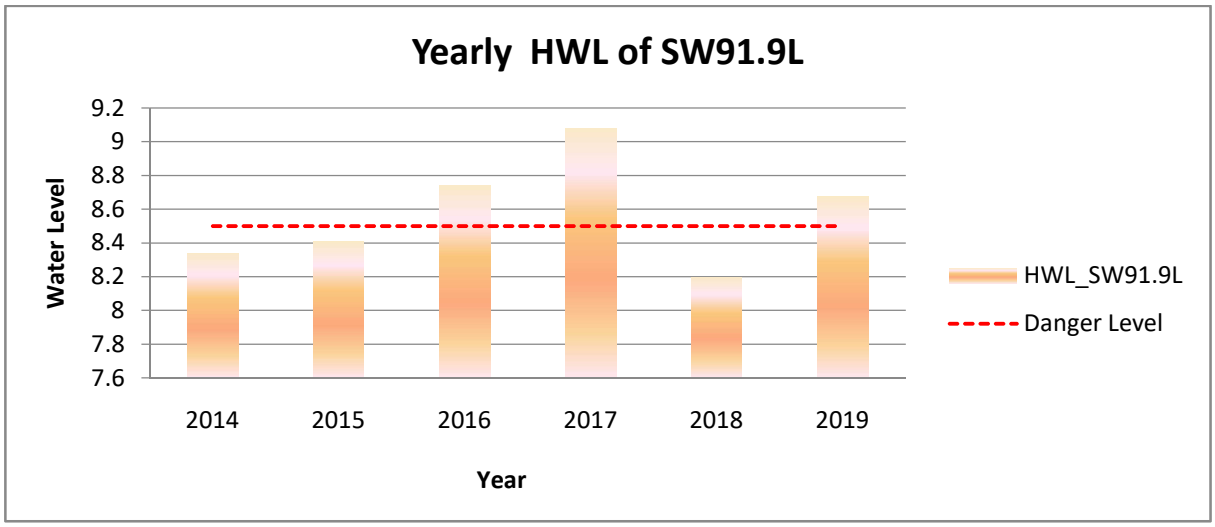

Figure: Yearly Highest Water Level VS danger Level (SW91.9L)

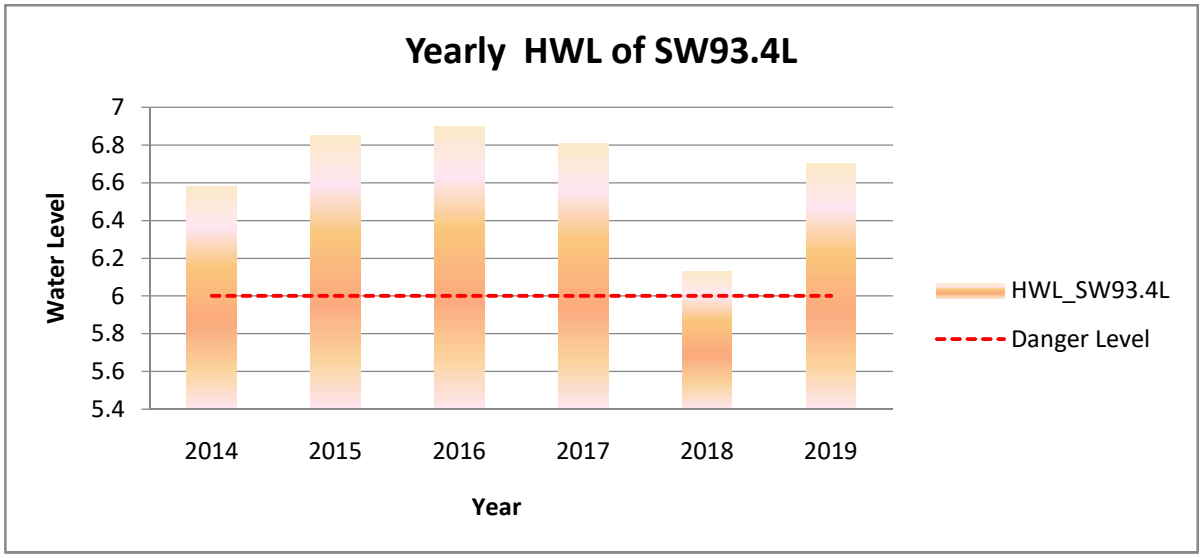

Figure: Yearly Highest Water Level VS danger Level (SW93.4L)

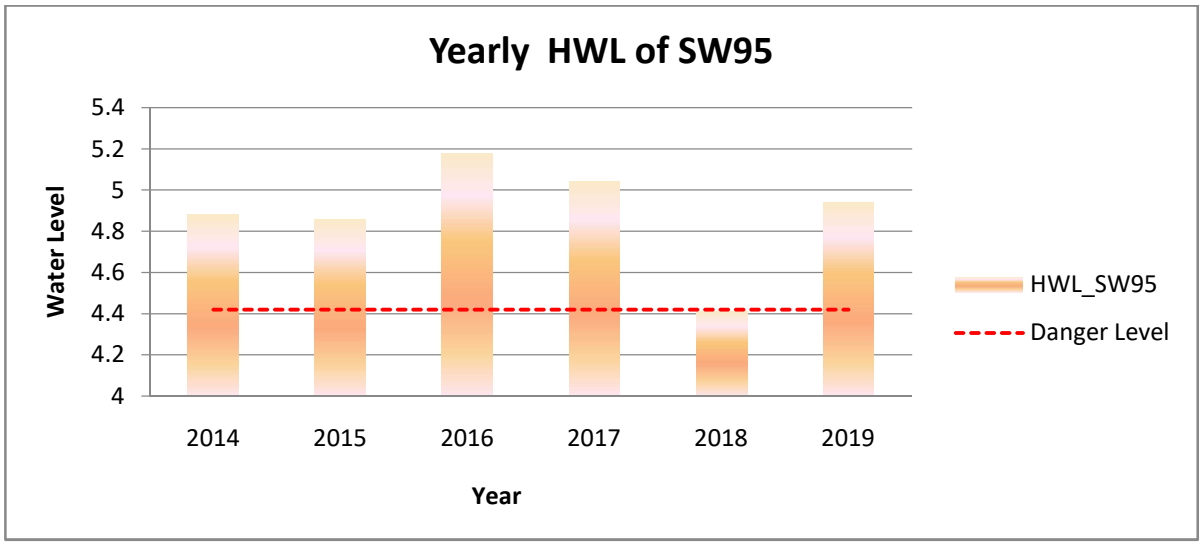

Figure: Yearly Highest Water Level VS danger Level (SW95)

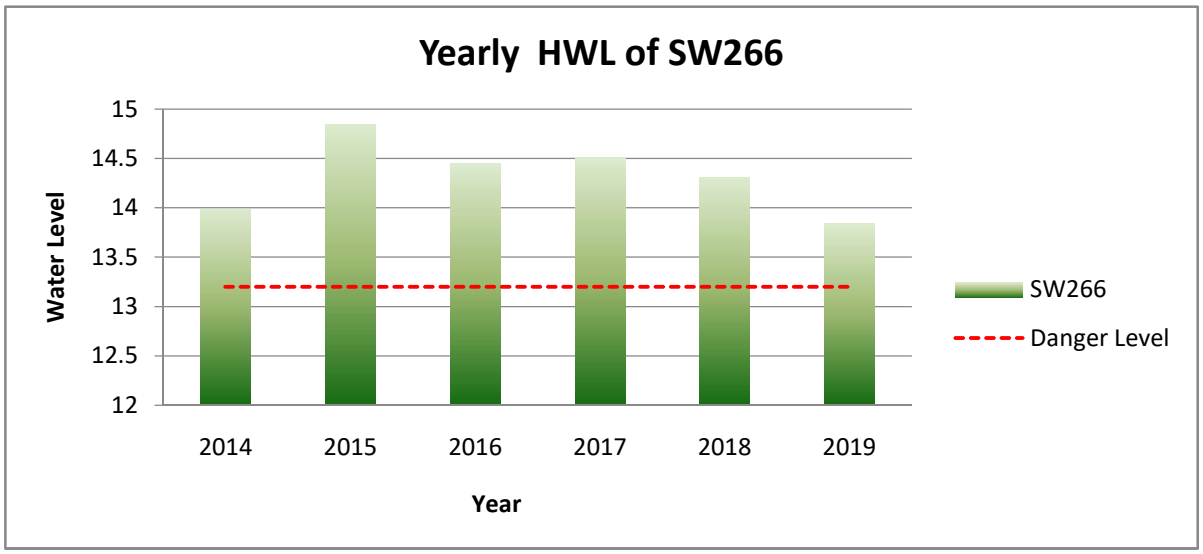

Figure: Yearly Highest Water Level VS danger Level (SW266)

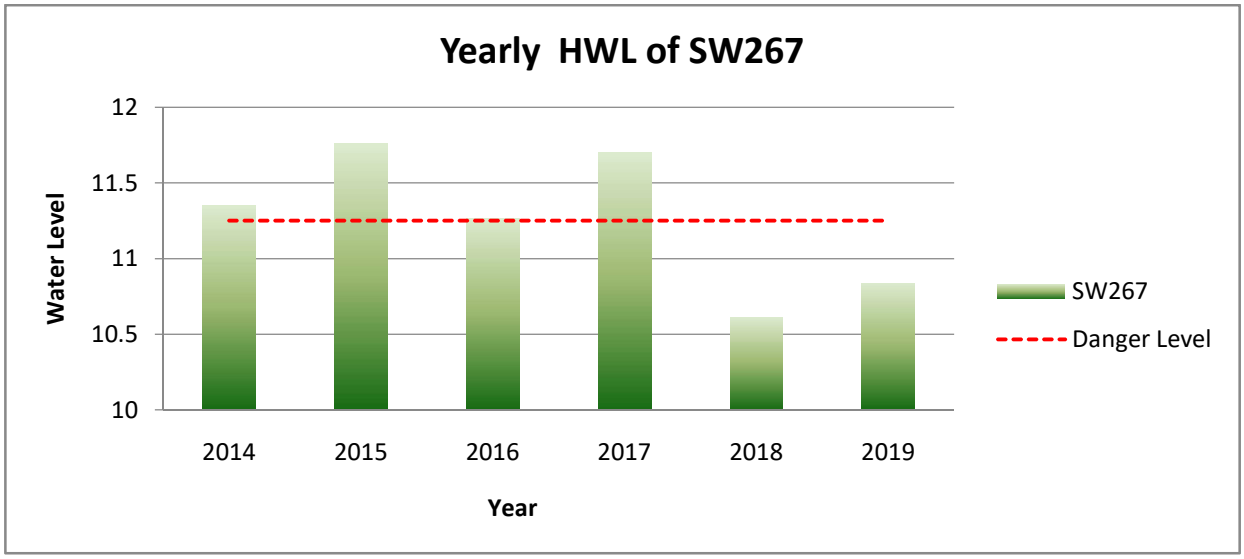

Figure: Yearly Highest Water Level VS danger Level (SW267)

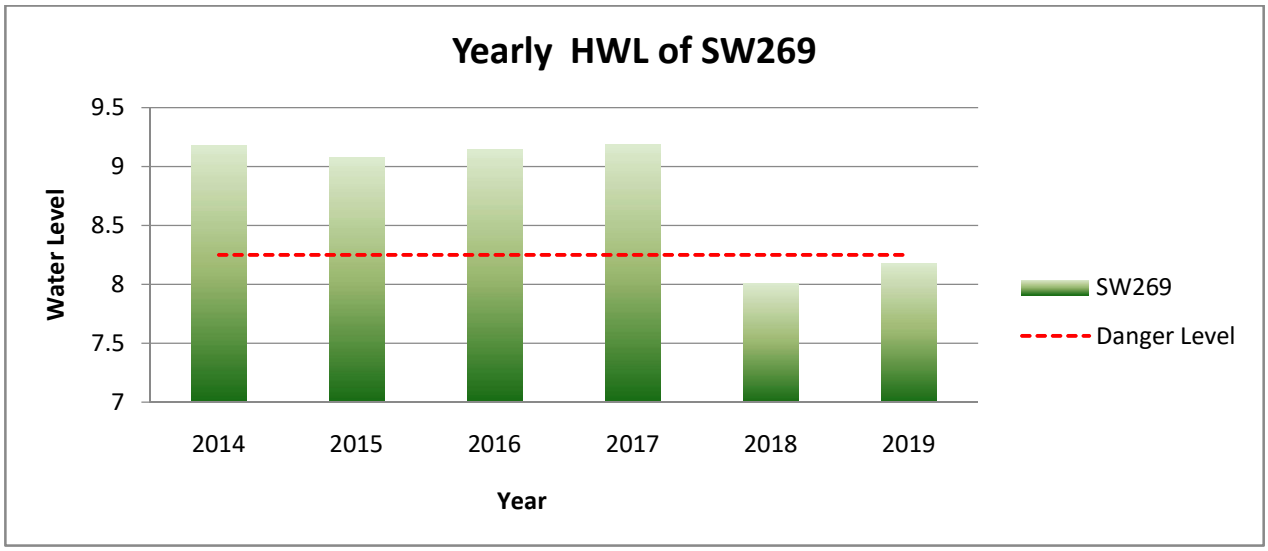

Figure: Yearly Highest Water Level VS danger Level (SW269)

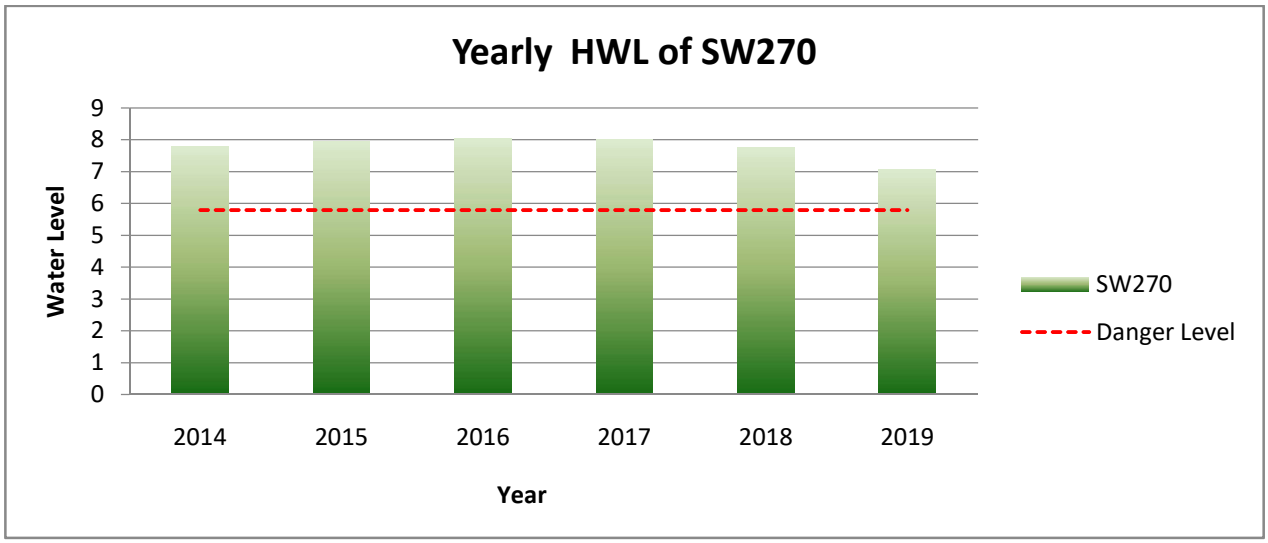

Figure: Yearly Highest Water Level VS danger Level (SW270)

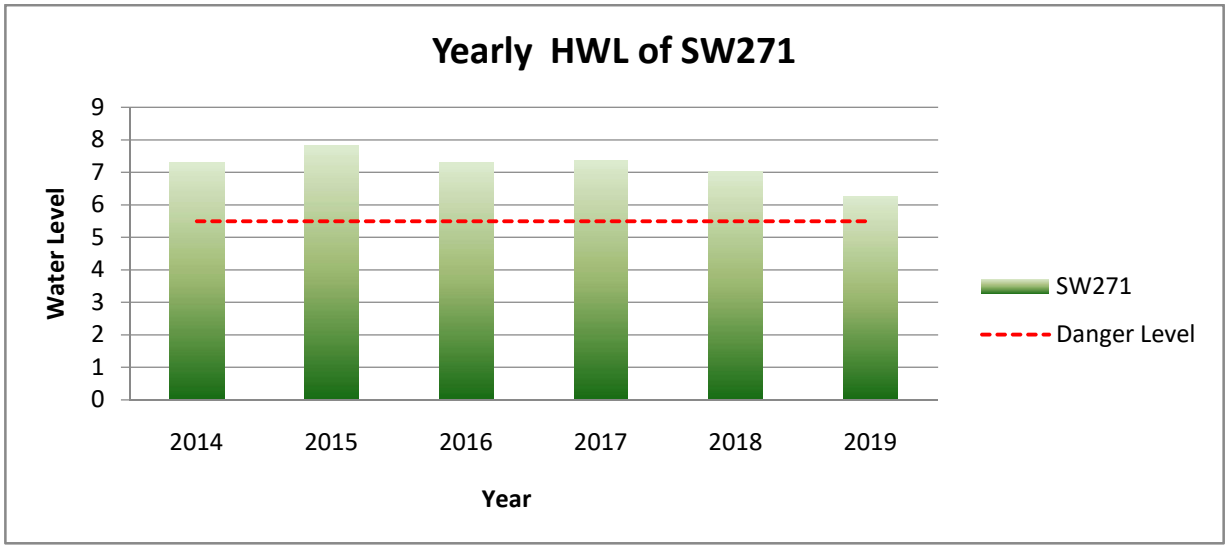

Figure: Yearly Highest Water Level VS danger Level (SW271)

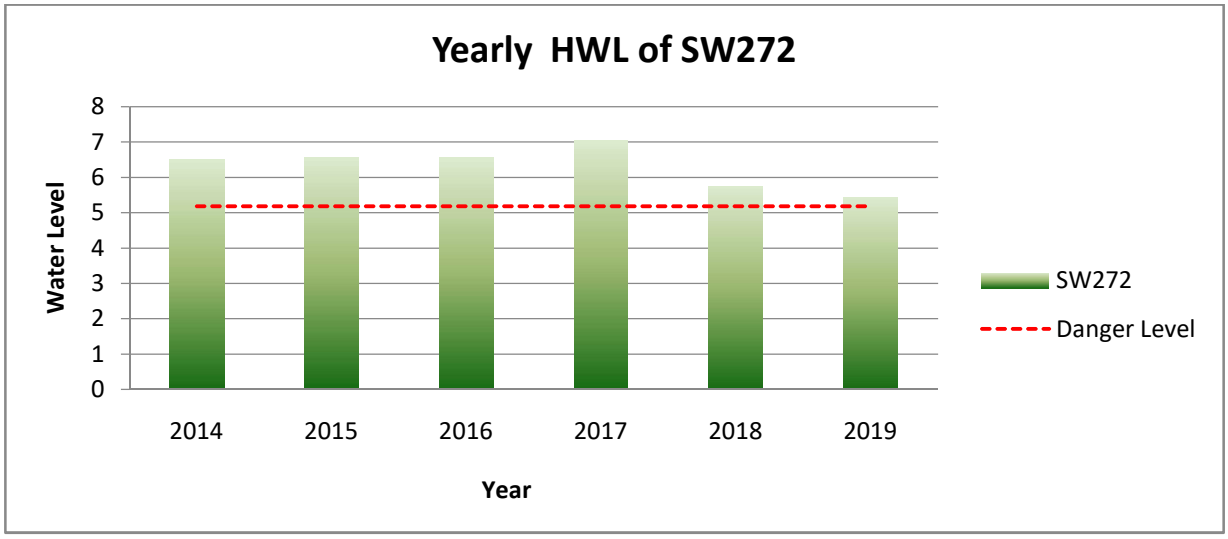

Figure: Yearly Highest Water Level VS danger Level (SW272)

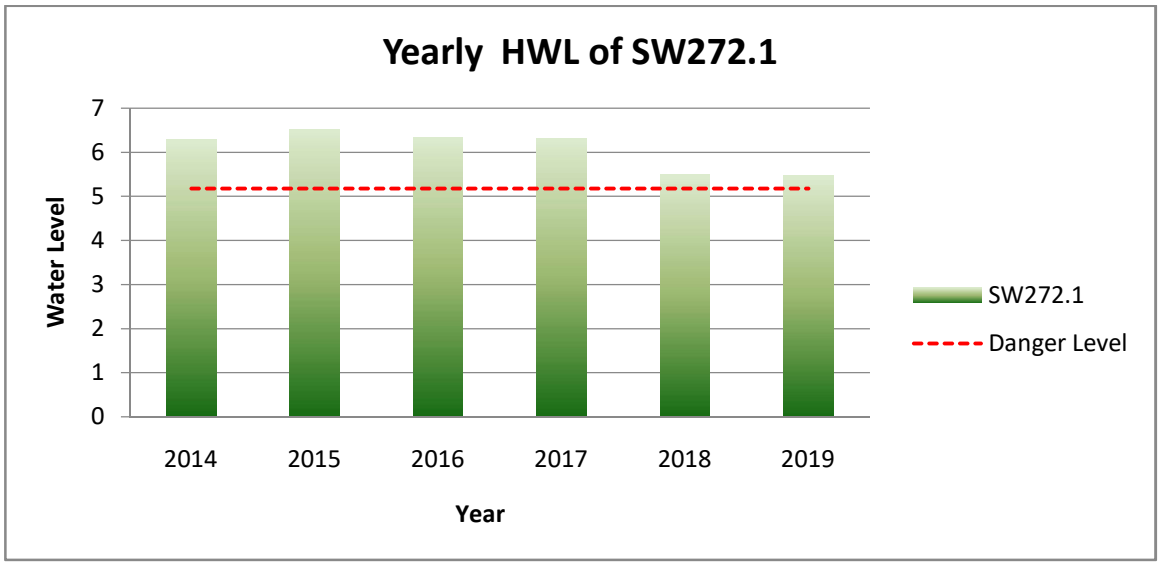

Figure: Yearly Highest Water Level VS danger Level (SW272.1)

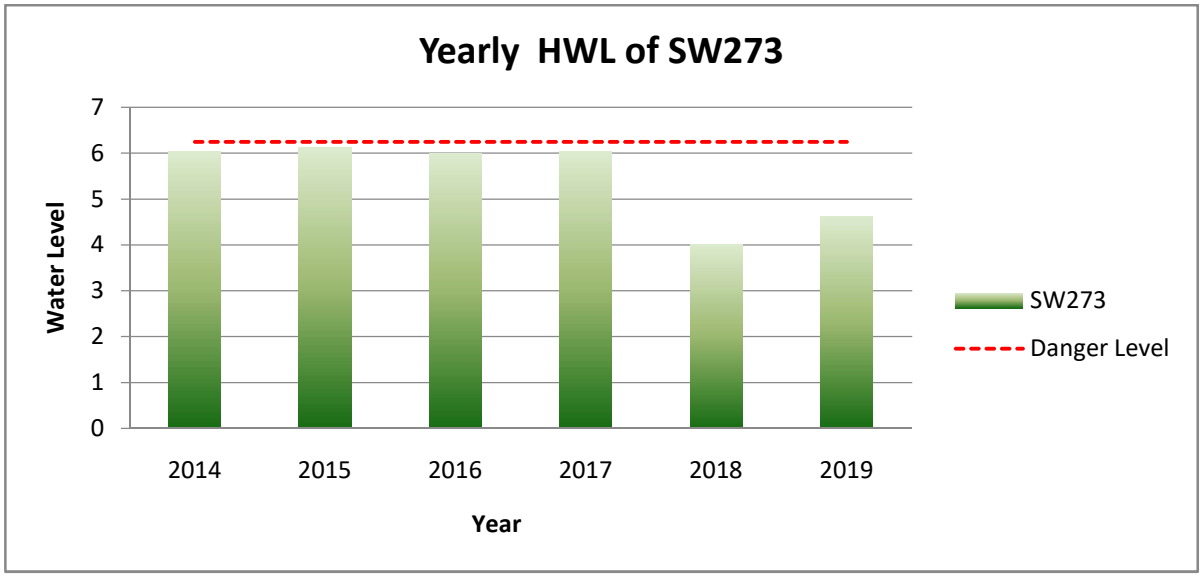

Figure: Yearly Highest Water Level VS danger Level (SW273)

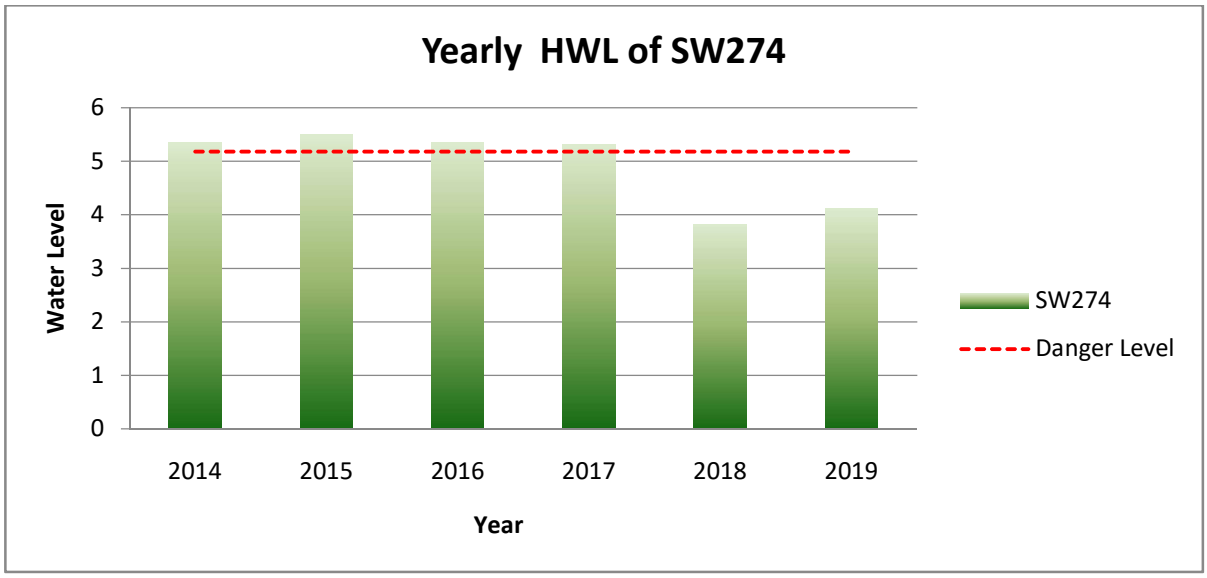

Figure: Yearly Highest Water Level VS danger Level (SW274)

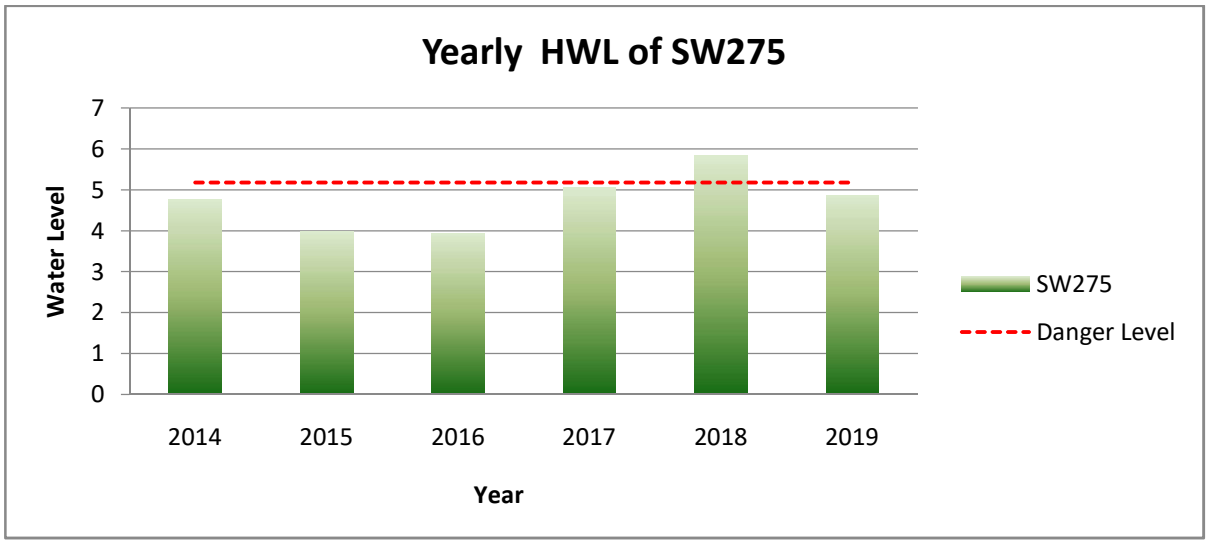

Figure: Yearly Highest Water Level VS danger Level (SW275)

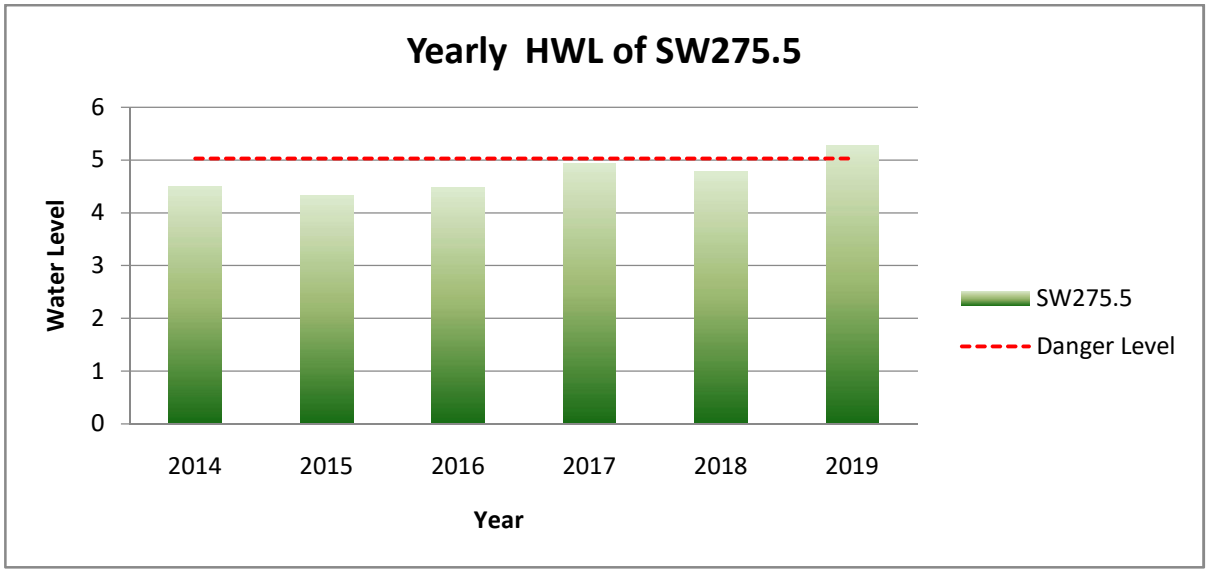

Figure: Yearly Highest Water Level VS danger Level (SW275.55)

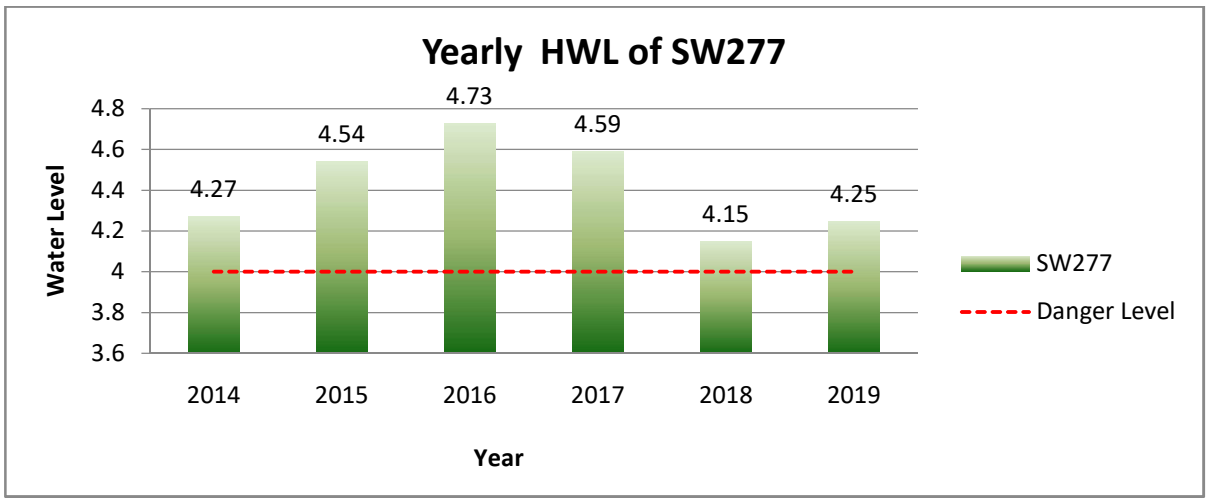

Figure: Yearly Highest Water Level VS danger Level (SW277)

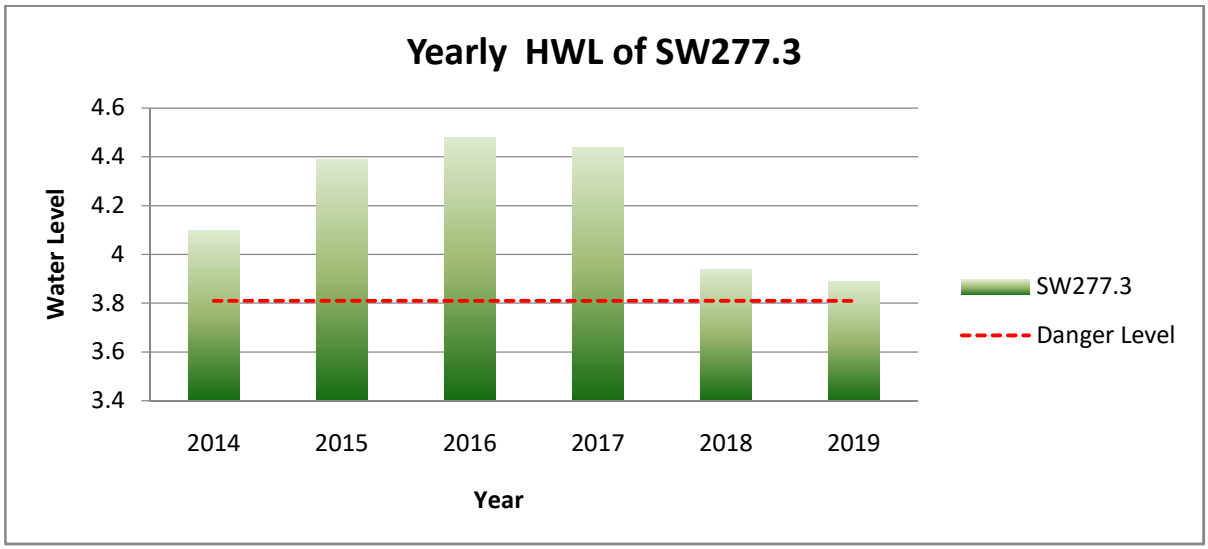

Figure: Yearly Highest Water Level VS danger Level (SW277.3)

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