Birgunj Metropolitan City

Secondary Towns Integrated Urban Environmental Improvement Project

(STIUEIP)

Project Implementation Unit

Birgunj, Nepal

Report on July 2019 Flood

Prepared and submitted by **Design and Supervision Consultant**

SMEC International Pty, Australia
in association with
Brisbane City Enterprise Australia
Building Design Authority, Nepal and
CEMAT Consultants (P) Ltd, Nepal

Funding Agency:	**Executing Agency:**
Asian Development Bank (ADB) and Government of Nepal	Government of Nepal Ministry of Urban Development Department of Urban Development and Building Construction

July 2019

Table of Contents

1. BACKGROUND

This report has been prepared to describe the reasons behind the occurrence of flooding July 2019 and to answer the query put by Project Manager by his letter 539/075/076 dated 16 July, 2019 and we would like to express our disagreement on the allegation made by the media or whoever concerning the so called defunct of underground drainage constructed under the Contract Package no STIUEIP/W/BRJ/ICB-01. The design of the storm drainage system has been made based on the standard norm accepted and adopted nationally and internationally and based on the requirement envisaged in the Employer's requirement and budget availability. The design has been verified by the another Consultant Project Monitoring Support Consultant (PMSC) hired by the PCO(Project Coordinating Office) at Kathmandu and found satisfactory which was then accepted by PIU(Project Implementation Unit), PCO and ADB(Asian Development Bank) and process of procuring the Contractors under the International Contract Bidding(ICB) procedure were made.

Two numbers of sub-projects were designed namely

- Sewerage and Drainage, Sewerage Treatment Plant and Road and Lane Improvement sub-project. Package No. STIUEIP/W/BRJ/ICB-01. The Contractor involved is CTCE Kalika JV. This package has started on 27th April, 2014 and substantially completed on 20th June, 2019 and all the structures are functioning to the satisfactory level as envisaged in the design.

- Integrated Solid Waste Management Sub-project Package No. STIUEIP/W/BRJ/ICB-02. The Contractor involved is ZIEC. This Package was started on 1st April, 2016 and is under construction and has to wait few more months to complete the work and to come into function and all the solid waste generated within the Birgunj Municipality will find its safe destination which will play important role to improve the environmental condition of Birgunj Municipality and also to reduce the flooding problem.

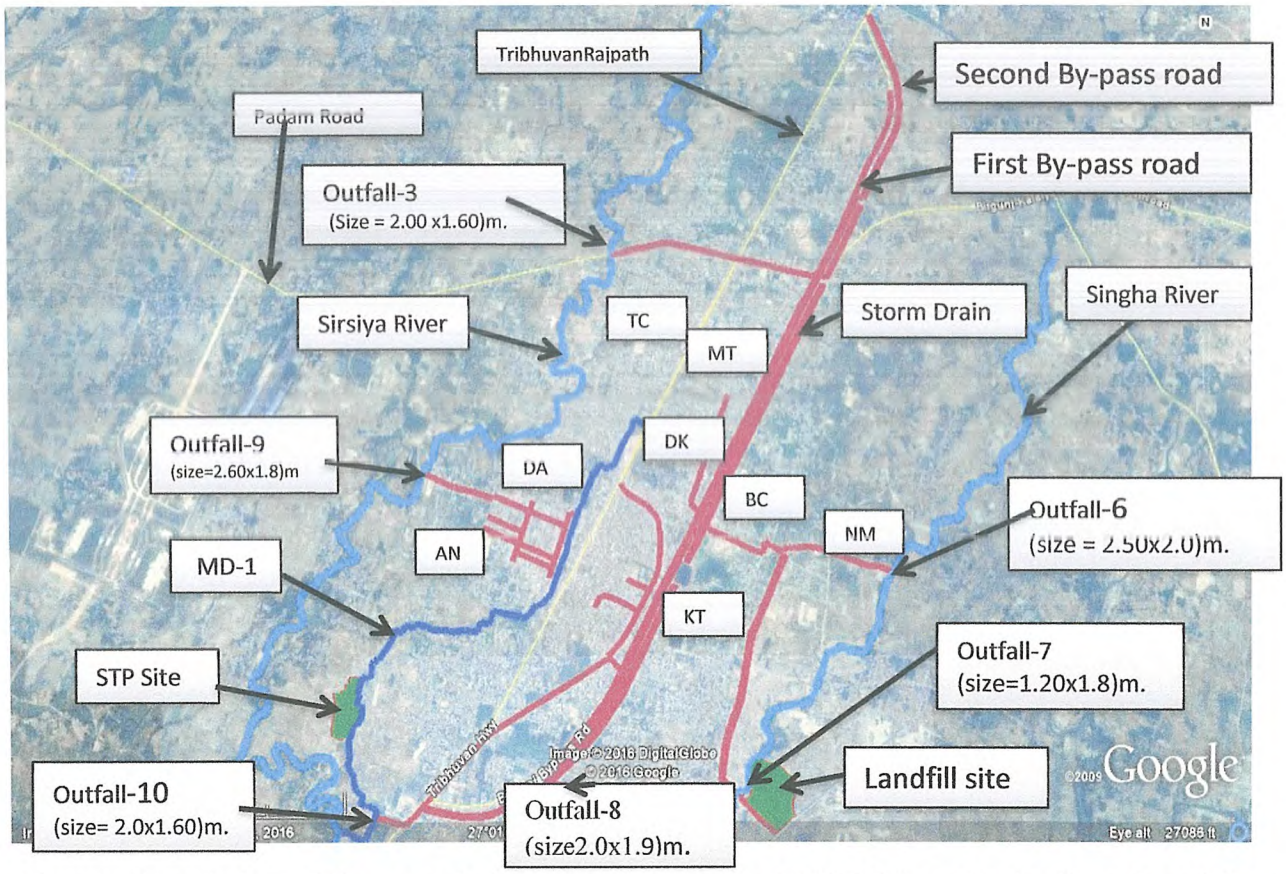
The issue arose concerning flood seen this year cannot be ignored but before launching any allegation one should understand the actual reason why flooding is seen this year which was not seen in previous years since the new drainage system has been installed.

The drainage system of the Birgunj Municipality was designed based on the topography, location of the streets and the possible outlets. In total 11 numbers of outlets has been Identified (Map of Birgunj in Appendix) constitute of main trunk drain and existing secondary drains that has been connected to the trunk line and ultimately discharging to the corresponding outlets. The 8(Eight) numbers outlets corresponds to namely 1,2,3,4A,4B,5,9 and 10 at Syrsiya and 3(Three) numbers outlets correspond to 6,7 and 8 are located in Singha river located on the western and eastern part of the Birgunj city respectively both flowing practically north to south. Due to the lack of sufficient fund only drains leading to drains correspond to outlets 3, 9 and 10 to Syrsiya and outlets 6, 7 and 8 to Singha rivers were constructed which are functioning properly. During the Construction stage, some improvement in design has been made for example at Daak Road a large sized RCC drain has been constructed replacing the

7open brick masonry drains. Similarly some of drains have been relocated to road center or another street to avoid collapsing of adjacent old tall buildings without decreasing the carrying capacity. The areas were identified as extreme flooding area and were considered as priority area for the design of drainage scheme. The locations of drains and outlets inside the core area of Birgunj are mentioned below:

1. Adarshanagar (AN)
2. Pani Tanki Daak Road (DK)
3. Murli Tole (MT)
4. Bhanu Chowk (BC)
5. Kumal Tole (KT)
6. Vishwa Tole(North of NMC road)(NM)
7. District Administrative Office.(DA)
8. Trimurti Cinema (TC)

Figure 1: Location Map



After the installation of the new drainage system under STIUEIP has drastically reduced the flooding problem in all the locations. It has been seen flooding at first normal rain mainly at Adarshanagar for hours just because most of the inlet chambers were blocked due to the accumulation of plastics material obstructing water entering to the drain. Once they were cleared no flooding being seen afterward. For the abnormal rain it is obvious that there is high chance of flooding. It is to note that the STIUEIP do not cover all the Birgunj area for example Murli area, Trimurti area and Vishwa Tole which are also flood prone area not addressed at present and included in RUDP which is under construction.

2 REASONS BEHIND THE FLOODING

2.1 High Intensity of Rainfall

The main reason of flooding is occurred when the intensity of rain fall is found higher than the intensity considered during the design. The design discharge for the storm drains were considered for return period of two years which is maximum 146 mm within 24 hours and any rainfall intensity higher than two years return period will obviously result the increase of volume of run-off water more than the capacity of the designed drain and ultimately increased in detention time that means the excess water will remain accumulated on the ground or street for longer period resulting flooding of street. As the rainfall intensity decreases or rain stops the excess water will then start flowing towards the drain and ultimately discharging to outlets. As the volume of water accumulated on the ground increases for the available area the depth of the water also will increases i.e the water level will start rising and will require longer time to drain off. As the water level is raised there is possibility of entering water inside the houses, shops with shallow plinth level. This phenomena was seen this year during 2nd week of July, 2019 when rainfall of 573mm was recorded at Simara Rainfall Station (Bara District) during the period of 09-15 July,2019(see rainfall data was recorded in Simara Airport the nearest hydrological station no.909 and a 24hrs rain of 206 mm which is greater than rain fall for 2years return period of 146mm. According to Table 1: For Birgunj Area the rain fall intensity of 206mm falls under 5years return period. As the system was designed for 2 year return period hence, streets of Birgunj area was found flooded for more than 24hrs. See more pictures below. As per Table 2 the highest rainfall of 439.85mm was occurred on August 2009 which is correspond to 100 years return period.

Table 1 : Rainfall intensity over Birgunj Area considered during design

R-Period in years	2	5	10	15	20	25	50	100
Rainfall 24-hrs in mm	146	204	243	265	280	292	328	364

Source: Main Design Report

Table 2 : Rainfall intensity Data

Year month	Max 24 hr Rain	Date	Remarks
2009 August	439.85	30	100 years return period (yrp)
2010 July	328.96	27	
2011 August	197.01	16	Less than 5 yrp
2012 June	64.34	13	
2013 October	79.22	10	
2014 October	56.78	14	
2015 July	121.31	21	
2016 July	134.62	28	
2017 August	361.77	29	100 yrp
2018 August	152.17	20	Greater than 2 yrp
2019 Feb	132.7	8	
2019 June	70.5	16	
2019 July	206	12	5 yrp

Source: Weather.com and Simara Airport .and attached in **Appendix**.

2.2 Flat Terrain (Ground Topography) and Shallow Riverbed

The Birgunj area lies in flat plain area having a gradient of 1:1000. This city is bordered by Singha river in east and Sirsiya river in west and the level Tribhuvan Rajpath lies in between the two rivers and is found almost higher and the ground is sloped towards the rivers and water flows accordingly. Besides TRP on west a large sized drain so called main drain (MD-1) flows from near post office run south across the Birgunj city and discharge to Sirsiya near India Boarder. This the main drain inside the core area which shall carries more than 60% runoff water generated within core area. This drain is in general full of garbage discharging less than 50% water of its normal cleaned condition. The flood prone areas listed above are located in low land area so all the water before being reached to outlets start accumulating on those low land locations causing flood in the absence of proper drains.

The river section is not very deep and the level difference between river bank and the river bed is hardly at the range of 3 to 5m max. During the monsoon normal rainfall the high water level usually reached almost near the top of the river bank and during abnormally high rain fall the water level use to raise lot above the river bank and used to spill out and poured all over the area . The water level used to rise even above the deck of the major bridges. In this situation it can be said that none of the drainage system can discharge that volume of water for several hour time when the natural drain become undersized. This year the intensity of the rain was so high that water level was raised even above Tribhuvan Rajpath which is the highest ridge point of Birgunj.

2.3 Encroachment of River Bank

Sirsiya river used to be much wider than at present condition that has resulted decreased flow capacity of Sirsiya and Singha rivers. The narrowing of width of the river has occurred due to encroachment by the public as well as by dumping of solid waste along the river bank narrowing the river width and raised river bed level due to deposition of silt and sand. Sirsiya is found narrower at downstream near India Boarder (besides Sewer Treatment plant) than upstream and the water flow capacity become low. During the flash flow due to reduced discharging capacity water start back flowing causing rise in water level resulting flooding.

2.4 Increase in Runoff Water due to Urbanization

Urbanization significantly changes watershed response to precipitation. As a result of urbanization, imperviousness in watershed area is increasing substantially. The most significant effects are reduced infiltration and decreased travel time, which substantially increase peak runoff. Runoff is estimated primarily by the amount of precipitation and by infiltration characteristics related to soil type, soil moisture, antecedent rainfall, land cover type and surface retention.

2.5 Lack of Routine Maintenance

The most of the existing drains were open drains and were not functioning properly and water cannot flow to its full capacity due to lack of maintenance as well as their misuse by the local people as waste dump site. These drains were also inadequate in hydraulic capacity to drain surface runoff effectively during monsoon season causing inundation at a number of locations in the core area of the city.

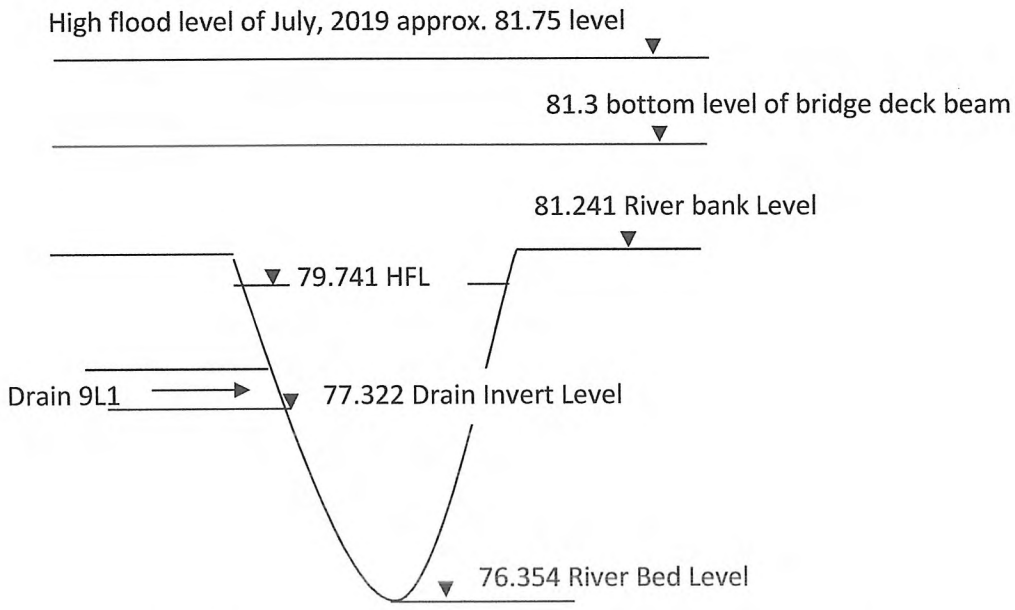
3 A BRIEF DESCRIPTION OF THE MOST FLOODED PRONE AREAS

3.1 Adarshanagar Area

This area is supposed to be the main business center and the heart of the city. Though this area was planned many years ago but proper provision was not made to collect the storm water from the streets. The existing east –west direction drains located in this area between the two rows of building are being used as combined sewer. In one hand, these drains are itself inadequate in size and capacity and on other hand these are full of garbage, plastics, silt and other wastes. During the heavy rainfall these drain are not capable to drain off the storm water and there is accumulation of water on the street. The maximum accumulation of storm water takes place in the main Chowk (Junction) area around the Kailash Hotel which is situated comparatively at lower elevation.

Main drain Md1 flows east of Aadarshnagar area and was collecting all the storm flow of this area. This drain was not maintained properly and was filled with garbage and plants. There was also encroachment at some locations reducing the carrying capacity of the drain which causes further inundation in Adarshanagar area. To improve the situation, a main drain 9L1 was constructed along Laath Galli flowing east to west to discharge its flow into the Sirsiya River flowing west of Adarshanagar. This drain is also connected with MD1 and diverts about half of its flow to Sirsiya river during monsoon time. This main drain 9 l1 collects storm water from whole of the Adarshanagar area through two branch drain 9L1K and 9L1R running north to south which collects the water from Adarshanagar and drain off it in main drain 9L1. The details of level at outlet point in Sirsiya river and connecting drain are given below.

Bed level of Sirsiya river at outlet point of drain 9L1	: 76.354m
High Flood Level of Sirsiya river at outlet point of drain 9L1	: 79.741m
Level of river bank at outlet point of drain 9L1	: 81.241m
Invert level of outlet point of drain 9L1	: 77.322m
Dimension of drain 9L1 at outlet point to Sirsiya river	: 1.60m x 2.60m (HxB)
Invert level of junction point of drains 9 L1 and 9Lk	: 79.315m
Ground level at Kailash Hotel (lowest point)	: 81.00m



Cross Section of Sirsiya river at Outfall No. 9 (not in scale)

It is to be understood that the system has been designed for 2 year retention period and the HFL in the river has been calculated accordingly. The HFL of the river water is 79.741m which is about 0.426m higher than the invert level of the junction point. Even during the HFL, there is no chance of backflow of water from Sirsiya river through the junction point. During the years, when there is sever rainfall of higher intensity for longer duration, the water level in the river will goes much higher and even can overtop the river banks. In such a situation the drain will be defunct and even backflow from the drain may occur causing chances of inundation of the surrounding area.

As per the discussion with the local people, the overtopping of the Sirsiya river took place at a number of locations during the continuous rainfall of about three days and whole surrounding area was flooded. The river water entered in the city area in upstream side and also caused flooding in downstream part. In such a situation, the inundation of water in Adarshanagar area could not be avoided causing the main reason of flooding.

3.2 District Administration Office

This office is located at low level area on the western side of main drain MD1. This area is situated even on a lower elevation than the existing bank of MD1. There is no other source nearby to drain out this area. During the dry season MD1 drains out this area easily but when there is high intensity rain, the MD1 flows to its

full capacity, the water from this area cannot be drain because of being situated on lower elevation and there is occasional flooding of this area during monsoon period. There is problem of inundation of water in this area almost every year a number of times.

One drain was constructed on eastern side of the boundary of this office and rehabilitation of the existing drain inside the office area was made to reduce the possibility of flooding during monsoon hours. This improvement has been found helpful for normal monsoon period but after the high intensity rain when MD1 flows to its full capacity there are chances of inundation of water for some time until the water level in MD1 subside to a certain level.

3.3 Daak Road

This area is also one of the prone area to flood and every one hour rain due to the lack of proper drainage used to accumulate storm water and used to enter inside the houses not only the water also floating waste, silt, sand, insects and even snakes etc. People were suffering a lot from snake bites, disease and facing difficulties coming out of houses. Once the new drainage has been placed this kind of problem is almost solved no flooding being seen except during this year abnormal rain slight flooding was seen for few minutes. No drainage being provided at Murliarea in STIUEIP so some part of storm water used to enter in to the Daak road area and drain was found capable to carry this water too.

4 CONCLUSION

Flooding seen this year during the period of 9 to 15 July, 2019 just due to the abnormal continuous rainfall for 3 days heavy flooding being seen and detained for several hours. The public mainly from Adarshanagar area claimed the entering of water inside their houses and shops damaging goods kept within the ground floor. Analyzing the rainfall intensity which is much higher than the considered two year return period in design, this kind of incidents are unavoidable at present condition. The rainfall recorded at Simara Airport was as much as 573.0 mm during the period of 9 to 15 July 2019 and 24hrs rain recorded is 206mm which is equivalent of 5 year return period and much higher than the two years return period rain of 146mm considered during design. There are other factors as described above that became reasons for flooding. Hence, necessary preventive measures are to be done by the Birgunj Metropolitan City to reduce the flooding events in future.

5 RECOMMENDATIONS

Finally the Birgunj Metropolitan shall take in to account following:

5.1 Maintained proper Functioning of the Existing Drainage System

- Encourage people to keep city clean and shall discharge solid and liquid waste only at designated place. People dumping solid waste haphazardly on the street, on the drain as it is dumping site resulting reduction in the carrying capacity.
- Stop dumping of Construction material at street it has been seen blocking of drain at many locations
- Regular maintenance of storm drain and keep drain and its inlet clean all the times.
- Handsome penalty shall be implied to those miss used the drain

5.2 Extension of Storm Water Coverage Area

As explained above STIUEIP do not cover all the Birgunj area so RUDP has been introduced but still further projects are needed to cover whole Birgunj Area. Similarly all the secondary drains at all the internal area of Birgunj also shall be properly designed and constructed.

5.3 Proper Management of River Basins and Banks

As described above due to encroachment of the river from both side of banks of discharge capacity of Sirsiya and Singha rivers in long run is decreasing due to two reasons, one is reduced width of river, other is gradual siltation of river bed giving rise to reduced cross section area ultimately triggering reduced discharging capacity of river, unless a comprehensive Sirsiya river management project including bed level management comes into operation. Flooding in future will become unavoidable and even more sever. Hence, either river capacity shall be increased by enlarging the river section which is not easy since the river ultimately enters in India or to divert some part of the flood water to other nearby stream in upstream area near Chure Hills or by any other probable method so that over topping of Sirsiya and Singha river can be avoided. So the Metropolitan City is required take appropriate long term policy to minimize the flooding in Birgunj Core area.

6 PHOTO FEATURE OF JULY 2019 FLOODING

Waste water Treatment Plant, Chhapkaiya area

MD1 just disappeared beside STP even after rain stopped

MD1 just disappeared beside STP even after the rain stopped

MD1 just disappeared beside STP

Water entered into lab buil;ding inside STP behind the fence with wall is MD1

Water level raised more than half of 1.2 m high boundary wall inside STP

Sirsiya River	
	Subsiding Water level at Sirsiya after the end of rain
	Subsiding Water level at Sirsiya after the end of rain
	Sirsiya and surrounding area During the full flood
Padam Road (Shirsiya River) area	

Subsiding Water level at Sirsiya after the end of rain down stream of Bridge

Padam Road near Sirsiya During the full flood

Padam Road near Sirsiya During the full flood people struggling to reach home

Padam Road near Sirsiya During the full flood people finding difficulties t

District Administration Office Area

Chief district Officer on flood monitoring on boat towards Ghantaghar area

Chief district Office on flood

Chief district Office entrace besides MD1

Ghantaghar area

Chief district Officer on flood monitoring on boat towards Ghantaghar area

Adarshanagar Area

Lowest point at Adarshanagar

Lowest point at Adarshanagar

Lowest point at Adarshanagar

Other area at Adarshanagar

Sigha River and Landfill Site Naguwa area

Singha River rised near to footpath level at Mashanghat

Singha River entered into Leachate Treatment

Sirsiya River outfall-3 (size= 2.0x1.60)m.

Sirsiya River Outfall-9 (size=2.60x1.80)m.

Sirsiya River Outfall-10 (size = 2.0x1.60)m.

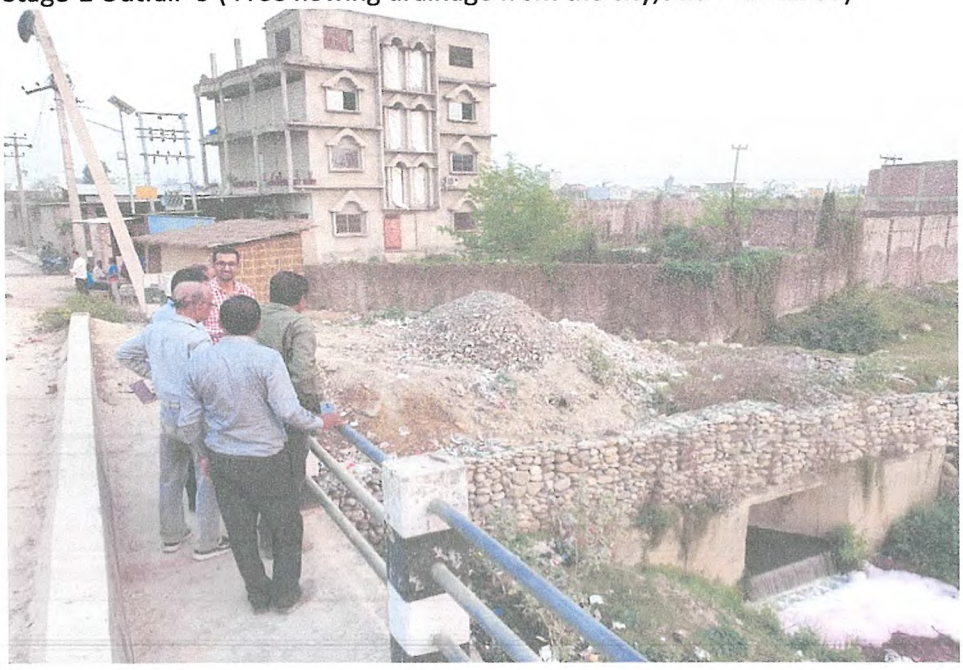
Shingha River Outfall-6 (size = 2.50x2.0)m.

Shingha River Outfall-7 (size= 1.20x1.80)m.

Shingha River Outfall -8 (size=2.0x1.90)m.

Stages of Flooding at Outfall-9

Stage-1 Outfall -9 (Free flowing drainage from the city,Size = 2.6 x1.80)



Stage-2 Overtopping and Plugging of Outfall-9 during rainfall

Stage-3 of Overtopping and Plugging of Outfall-9 during rainfall

Stage-4 Overtopped and plugged Outfall no.-9

Stage-5 Sirsiya River course high flood level rising during rainfall

Stage-6 Sirsiya River course high flood level rising to deck level of bridge.

Stage-7 Sirsiya River bridge submerged due to high flood level.

7

SMEC in association with
BCE/BDA/CEMAT

APPENDIX

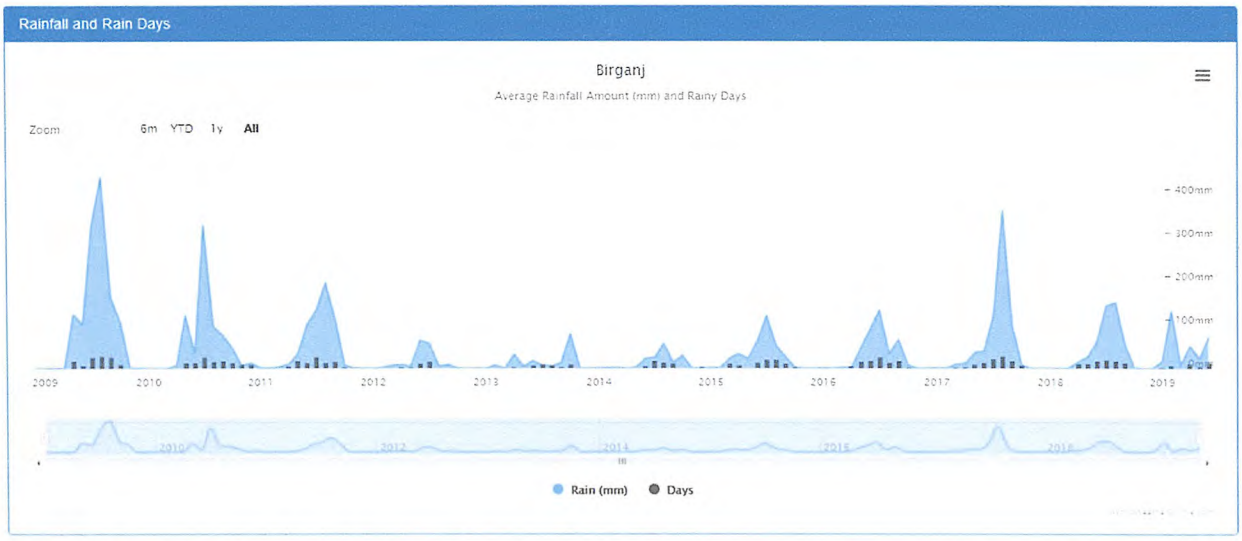
Government of Nepal
Ministry of Energy, Water Resources and Irrigation
Department of Hydrology & Meteorology

PRELIMINARY WEEKLY WEATHER SUMMARY FOR WEEK No.28 (09 - 15 July, 2019)

StationNumber	District	Station	Elevation	Weekly Rainfall in mm								Weekly Temperature in °C								
				This week					Last 3-weeks			Maximum					Minimum			
				Total	Normal	Percentageofnormal precipitation(%)	No.ofrainydayswith mmormore	hrshighestrainfall &date	Total	Normal	Percentageofnormal precipitation(%)	Average	DeparturefromNormal	Highestmax&date	No.ofdayswith30°C ormore	Departurefrom previousweek	Average	DeparturefromNormal	Lowestmin&date	No.ofdayswith0°C orbelow	Departurefrom previousweek
104	Dadeldhura	Dadeldhura	1879	83.0	78.6	105.6	6.0	27/12	84.1	156.0	53.9	23.3	-0.9	26.6/10	0	-1.8	17.7	0.5	15.7/15	0	-0.8
107	Darchula	Darchula	945	111.5	150.6	74.0	7.0	27/13	337.4	374.2	90.2	27.9	-3.9	31.5/10	1	-3.8	22.0	0.4	21/15	0	0.0
209	Kailali	Dhangadhi	184	210.0	144.8	145.0	7.0	82/11	151.3	272.3	55.6	31.5	-1.4	33.3/9	6	-3.0	25.4	-0.3	23.5/15	0	-1.2
218	Doti	Dipayal	563	51.2	59.5	86.1	6.0	19/14	37.9	133.4	28.4	32.2	-2.0	35.5/10	6	-3.8	24.7	0.6	23.5/15	0	-0.9
303	Jumla	Jumla	2363	38.0	40.3	94.3	6.0	13/9	87.6	69.4	126.2	22.1	-2.9	25.6/10	0	-3.7	15.9	0.2	14.8/14	0	-0.6
406	Surkhet	Surkhet	720	148.0	119.6	123.7	7.0	59/9	230.0	252.9	90.9	29.8	-1.0	32.2/14	4	-1.7	23.6	0.2	22.5/15	0	-0.4
420	Banke	Nepalgunj Airport	165	348.0	138.1	252.0	6.0	160/9	280.5	219.4	127.8	32.4	-1.0	34.6/15	7	-3.5	24.8	-0.8	23.3/14	0	-1.4
513	Rukum	Chaurjharitar	863	126.5	78.3	161.6	6.0	55/10	105.0	163.4	64.3	28.6	-3.3	32/14	2	-6.1	21.9	-0.6	20.5/14	0	-0.6
515	Dang	Dang	663	190.2	101.8	186.8	6.0	66/13	210.0	232.5	90.3	29.1	-0.9	31.9/14	2	-3.1	23.6	0.6	22.8/14	0	-0.8
601	Mustang	Jomson	2741	5.5	8.1	67.9	3.0	3.5/9	33.5	19.2	174.5	25.1	2.2	27/12	0	-0.4	13.4	-3.3	12.5/14	0	-0.6
604	Mustang	Thakmarpha	2655	10.3	15.5	66.4	3.0	6.3/9	52.8	41.0	128.8	20.9	-0.8	22.5/11	0	-2.5	12.8	-0.1	12/14	0	-0.1
702	Palpa	Tansen	1183	202.8	137.9	147.1	5.0	71.5/10	140.3	260.4	53.9	25.2	-2.5	27/15	0	-4.2	18.6	-1.3	17.5/13	0	-1.3
705	Rupendhi	Bhairawa Airport	108	267.0	153.4	174.1	6.0	107/13	50.4	256.7	19.6	31.0	2.0	35.6/15	4	-5.3	25.6	0.2	23.8/13	0	-3.1
715	Arghakanchi	Khanchikot	1801	292.2	149.4	195.6	6.0	119.6/10	247.0	268.6	92.0	21.6	-1.4	24.5/14	0	-3.1	17.6	0.1	16.5/13	0	-0.9
716	Kapilvastu	Taulihawa	106	345.7	145.4	237.8	7.0	202.5/13	54.1	226.7	23.9	29.9	-3.3	34.1/15	3	-6.2	24.4	-1.4	20/14	0	-4.1
804	Kaski	Pokhara Airport	827	88.8	248.4	35.7	6.0	37/14	415.6	608.6	68.3	29.3	-0.7	31.8/11	2	-3.2	22.8	0.7	21.9/13	0	-0.2
902	Chitwan	Rampur	189	240.3	132.2	181.8	7.0	70.4/12	106.7	349.4	30.5	30.9	2.2	34.4/15	4	4.3	24.5	0.5	23.2/13	0	1.9
909	Bara	Simara Airport	137	573.0	117.7	486.8	7.0	206/12	201.0	307.8	65.3	29.6	-3.0	34.5/15	3	-5.3	25.2	-0.4	24/13	0	-2.2
1030	Kathmandu	Kathmandu Airport	1337	217.4	82.8	262.6	6.0	104/13	175.9	222.0	79.2	25.4	-2.8	28/15	0	-5.0	19.5	-0.7	18.2/12	0	-1.6
1036	Kavrepalanchowk	Pachkhal	857	243.6	60.4	403.4	7.0	111.3/13	118.4	154.3	76.8	28.5	-2.9	30.5/15	3	-5.8	22.1	-0.5	20.5/13	0	-1.2
1038	Dhading	Dhunibesi	991	228.0	94.3	241.8	7.0	82.4/13	253.0	239.3	105.7	27.8	-2.8	31.5/15	2	-4.6	21.6	-0.2	20/13	0	-0.9
1103	Dolkha	Jiri	1877	179.2	123.7	144.9	7.0	89.2/13	393.8	391.8	100.5	22.6	-1.0	25.1/15	0	-3.1	17.3	0.2	16/13	0	0.3
1111	Dhanusa	Janakapur Airport	76	667.5	112.4	593.9	6.0	283.8/13	97.9	251.1	39.0	29.5	-3.2	34/15	3	-5.2	25.2	-1.0	24.5/12	0	-2.7
1122	Mohottari	Jaleshowar	68	368.0	43.6	844.9	4.0	195/13	108.7	183.7	59.2	29.9	-4.1	32/15	2	-4.7	26.0	0.1	25/13	0	-1.2
1124	Dolkha	Kabre	1755	170.1	152.0	111.9	6.0	63.7/13	258.6	347.3	74.5	23.4	-2.2	26/15	0	-3.7	17.8	-0.6	16.5/13	0	-1.0
1206	Okhaldhunga	Okhaldhunga	1731	269.6	107.9	249.9	6.0	107/12	82.3	285.5	28.8	21.6	-2.4	26.3/15	0	-5.3	16.8	-0.8	12.6/13	0	-1.6
1213	Udayapur	Nepaltar	469	939.6	107.9	871.1	7.0	231.4/13	197.8	282.2	70.1	28.3	-2.0	32/15	3	-6.8	23.5	-0.5	22.8/14	0	-4.0
1215	Siraha	Lahan	110	637.3	101.9	625.5	7.0	215.2/13	129.2	220.8	58.5	29.5	-3.1	32.5/15	3	-5.1	24.8	-0.8	24/13	0	-2.8
1223	Saptari	Rajbiraj	68	391.2	107.7	363.1	7.0	157.8/13	161.2	251.5	64.1	29.6	-3.0	31.1/10	1	-4.1	24.4	-0.7	23.2/15	0	-2.1
1307	Dhankuta	Dhankuta	1192	318.0	60.7	523.9	6.0	106/13	46.5	152.5	30.5	24.3	-2.7	27.2/9	0	-6.6	19.9	-0.5	18.9/13	0	-1.8
1311	Dharan	Dharan	310	502.4	124.1	404.8	6.0	155.8/12	111.5	340.1	32.8	27.7	-4.0	30.5/9	1	-6.2	24.1	-0.1	23.4/13	0	-2.9
1319	Morang	Biratnagar Airport	72	593.0	122.6	483.7	7.0	172/12	91.0	320.6	28.4	30.3	-1.7	35.8/15	3	-3.7	24.8	-0.9	24/14	0	-2.4
1320	Sunsari	Tarahara	120	608.4	128.7	472.8	7.0	240.8/12	117.5	317.2	37.0	28.3	-3.8	29.8/9	0	-5.0	24.4	-0.9	23.5/13	0	-2.9
1327	Sankhuwasabha	Khadbari	1064	84.8	89.3	95.0	6.0	29/12	131.2	224.0	58.6	26.7	-2.9	29/9	0	-4.7	21.1	-0.5	19.5/13	0	-1.7
1405	Taplejung	Taplejung	1744	157.0	95.8	163.9	7.0	42/13	193.7	245.5	78.9	22.1	-2.7	24.2/10	0	-4.9	17.8	-0.3	16.9/13	0	-1.5
1421	Jhapa	Kankai	107	749.8	178.1	420.9	7.0	202.5/12	143.1	440.2	32.5	25.2	-7.2	28/9	0	-4.1	24.2	0.5	23.5/13	0	-2.1

- Most of the stations received normal to above normal rainfall this week. Darchula, Doti, Mustang and Kaski received below normal rainfall.
- In past 3 weeks, above normal rainall was recorded in Jumla, Nepaljung and Mustang and rest of the country received normal to below normal rainfall.
- Maximum temperature is lower than normal except Jomsom this week.
- Maximum temperature is lower than previous week all over the country.
- Minimum temperature is lower than the preious week all over the country except Jiri .

SMEC in association with BCE/BDA/CEMAT



https://www.worldweatheronline.com/birganj-weather-history/np.aspx

7

SMEC in association with
BCE/BDA/CEMAT