

Internship at Hydropower Station: A Comprehensive Report

Date: 14th June 2023

Intern: Sheshraman Shrestha

Hydropower Station: Marsyangdi Hydropower Station

Introduction

This report provides an overview of my first day as an intern at a Hydropower Station. The purpose of the internship is to gain practical experience in the field of hydropower generation and familiarize myself with the operations and processes of the station. The report outlines the activities, observations, and key learnings from the first day.

Background

Marsyangdi Hydropower Station is a peaking run-of-river power station with an installed capacity of 69 MW with three units of 23 MW each and its annual design generation is 462.5 GWh. It is located at Aanbu Khairani, Tanahun in the central region about 114 km west of Kathmandu on Prithvi Highway and lies on the right bank of Marsyangdi River. It was commissioned in 1989 AD and developed with the assistance from IDA, KFW, KFED, SFD, ADB and GON at a cost of USD 22 million. The generation from this power station contributed 10.67% of the total energy to the INPS (Integrated Nepal Power System).

Salient Features of Marsyangdi Hydropower Station

1) General:

- | | |
|--|---------------------------------------|
| • Catchment Area: | 3850 sq.km |
| • Average Annual Discharge: | 210 m ³ /s |
| • Gross reservoir storage capacity: | 3.20 x 10 ⁶ m ³ |
| • Surface area at maximum operating level: | 62 ha |

- Maximum flood discharge: 3350 m³/s
- Minimum flood discharge: 33 m³/s

2) Head Works:

A. Weir

- Length: 98 m
- Design flood discharge: 9100 m³/s
- No. of gates (16 m wide): 5 Nos.
3 with 14.8 m high, 2 with 13.8 m high

B. Settling Basin

- Length x Width x Depth 400x74x10 to 12 m respectively

C. Flushing Structure

Width 44 m with 2 gate openings of each 16 m wide and 15.8m high

3) Intake:

- Type: Bell mouth
- Height: 11.5 m
- Width: 11.0 m

4) Waterways:

A. Headrace Tunnel: (Concrete line, Circular Type)

- Length: 7199 m
- Diameter: 6.4 m

B. Surge Tank: Throttled Shaft tube (Concrete-Lined)

- Height: 56 m
- Diameter: 20.5 m

C. Pressure Shaft: (Steel lined)

- Length: 75 m
- Diameter: 5 m

D. Manifold: (Steel lined)

- Length of each branch: 3 branches, 45 m, 30 m, 28 m
- Diameter: 2.8 m

5) Technical Data of Equipment:

A. Turbines:

- Type: Francis
- Number: 3
- Rated turbine discharge: 30.5 m³/s
- Rated speed: 300 rpm
- Rated output: 26 MW
- Head range: 90.5 to 95.0 m

B. Generators:

- Type: Vertical Shaft
- Number: 3
- Capacity: 30 MVA
- Power factor: 0.85
- Voltage: 11 kV
- Frequency: 50 Hz

C. Transformers:

- Type: Single Phase
- Number: 9
- Capacity: 3x10 MVA (per bank)
- Voltage ratio: 11/132 KV

6) Investment:

- IDA: US \$ 96.00 million
- KFW: US \$ 93.00 million
- KFED: US \$ 9.5 million
- SFD: US \$ 11.5 million
- ADB: US \$ 4.36 million
- Nepal Gov: US \$ 7.21 million

7) Construction & Operation Summary:

A. Commencement of construction:	Falgun 2043 (Feb.1986)
B. First impounding of reservoir:	Shrawan 2046 (Aug.1989)
C. Commissioning Date:	
• Unit 1	Since 27 Magra 2046 Dec.12, 1989
• Unit 2	Since 23 Kartik 2046 Nov.8, 1989
• Unit 3	Since 14 Ashwin 2046 Sep.30, 1989
D. Commercial Operation:	
• Unit 1	Since 12 Poush 2046 Dec.27, 1989
• Unit 2	Since 22 Marga 2046 Dec.7, 1989
• Unit 3	Since 20 Kartik 2046 Nov.5, 1989

Internship Day Highlights

Upon arrival at the Hydropower Station, I was warmly welcomed by the supervisor and introduced to the HOD of Civil Department, Mr. Dipendra Gupta Sir. I was instructed about the work I need to do in power station as well as in dam. By submitting my NOC, I went for the overview of the operations. I was provided with a comprehensive overview of the station's operations, including the different components involved in the generation of the hydropower. This included an explanation of the water intake system, turbines, generators, transmission lines, and control of room operations. The complexity and scale of the machinery involved in hydropower generation were impressive.

To enhance my understanding of the practical aspects, I was taken on a site visit. This allowed me to witness the various components of the hydropower station firsthand. I observed the water intake structure, turbines, and generators, as well as the transmission lines and distribution network. It was fascinating to see how water was harnessed to generate electricity efficiently.

I was not assigned to do the work but the department instructed me to learn more about the structure and analyze them. My second day would be in the Dam.

Key Learnings

Through the orientation and site visit, I gained a deep understanding of hydropower generation, including the technical aspects, the role of each component, and the overall process involved in converting water energy into electricity.

The emphasis on safety during the safety briefing underscored the criticality of maintaining a secure working environment in a hydropower station. It highlighted the importance of following safety protocols and wearing appropriate PPE to mitigate potential hazards.

The internship provides an excellent opportunity to apply the theoretical knowledge gained during academic studies to real-world scenarios. Working alongside professionals in the field allows for a deeper understanding of the practical challenges and solutions related to hydropower generation.

Conclusion

The first day of my internship at the Hydropower Station was both informative and inspiring. I was introduced to the operations, witnessed the infrastructure firsthand, and familiarized myself with the safety procedures. The experiences have further motivated me to learn and contribute to the field of hydropower generation. I look forward to the remaining days of the internship, where I will continue to learn and grow professionally in this organization.

15th June 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Internship Report: Second Day at Hydropower Station

On 15th June 2023, I continued my internship at Marsyangdi Hydropower Station. The second day of my internship was dedicated to conducting calculations of sediments in parts per million (ppm) and exploring the dam. This report provides an overview of the activities and learning experiences from the day.

Sediment Calculation

A. Procedure:

- 1) First, two empty bottle was taken and their weight was measured (Tare weight).
- 2) Sample was collected using the lever and fish-like device. The empty glass bottle was kept in device and immersed in to the river at 60% of depth of the river for about 1-2 minutes. Also, gauge height was measured (masl).
- 3) The sample was brought to the lab. The weight of the glass bottle with sample was measured (Gross Weight).
- 4) Two small ceramic container was taken and their empty weight with Glass Microfiber Filter paper (dia 24 mm) was measured (Tare weight).
- 5) Container was fixed to the conical glass vessel with rubber. Suction pump attached to the vessel was turned on.
- 6) The sample was poured through cone into the container.
- 7) The sediments were collected in the container and then it was taken to oven for drying out the sample.
- 8) After oven-drying, the container with dried sample was brought to room temperature.
- 9) The weight of container with dried sample was measured (Gross Weight).

B. Calculation:

Date: 15th June 2023

Time: 10:00 AM

Gauge Height: 337.3 m

Sampling Station: Sill-1

Bottle Number-3

$$\begin{aligned}\text{Gross Weight} &= 722 \text{ gm} \\ \text{Tare Weight} &= 370 \text{ gm} \\ \text{Net Weight(N1)} &= \text{Gross Weight} - \text{Tare Weight} \\ &= 722 \text{ gm} - 370 \text{ gm} \\ &= 352 \text{ gm}\end{aligned}$$

Container Number-4

$$\begin{aligned}\text{Gross Weight} &= 16.789 \text{ gm} \\ \text{Tare Weight} &= 16.146 \text{ gm} \\ \text{Net Weight(N2)} &= 0.643 \text{ gm}\end{aligned}$$

$$\begin{aligned}\text{Concentration (PPM)} &= \frac{N2}{N1} * 1000000 \\ &= 1826.7045\end{aligned}$$

Bottle Number-5

$$\begin{aligned}\text{Gross Weight} &= 678 \text{ gm} \\ \text{Tare Weight} &= 370 \text{ gm} \\ \text{Net Weight(N1)} &= \text{Gross Weight} - \text{Tare Weight} \\ &= 678 \text{ gm} - 370 \text{ gm}\end{aligned}$$

$$= 308 \text{ gm}$$

Container Number-12

$$\text{Gross Weight} = 17.264 \text{ gm}$$

$$\text{Tare Weight} = 16.714 \text{ gm}$$

$$\text{Net Weight(N2)} = 0.55 \text{ gm}$$

$$\begin{aligned} \text{Concentration (PPM)} &= \frac{N2}{N1} * 1000000 \\ &= 1785.7143 \end{aligned}$$

Utilizing the collected data, I applied the appropriate formulas and calculations to determine the sediment concentration in parts per million (PPM). This calculation involved the measurement of sediment mass per unit volume of water.

This task provided me with practical experience in utilizing scientific calculations to assess critical parameters in hydropower operations.

Dam Exploration

In addition to the sediment calculation task, I had the opportunity to explore the dam structure and gain insights into its design, construction, and operational aspects. This experience allowed me to understand the significance of dam safety and maintenance, as well as the complex engineering behind the hydropower infrastructure.

During the exploration, I familiarized myself with the various components of the dam, including spillways, gates, turbines, and penstocks. I gained an understanding of how these elements function together to generate electricity efficiently. The dam visit highlighted the importance of environmental considerations in hydropower operations.

Conclusion

The second day of my internship at Marsyangdi Hydropower Station was a productive and educational experience. Through the calculation of sediment concentration in ppm and the exploration of the dam, I gained hands-on experience in critical aspects of hydropower operations.

16th June 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Internship Report: Third Day at Hydropower Station

On 16th June 2023, I continued my internship at Marsyangdi Hydropower Station. The third day of my internship was focused on the same tasks as the second day, which included the calculation of sediment concentration in parts per million (ppm) and further exploration of the dam.

Sediment Calculation

Calculation:

Date: 16th June 2023

Time: 10:00 AM

Gauge Height: 337.5 m

Sampling Station: Sill-1

Bottle Number-106

Gross Weight	=	654 gm
Tare Weight	=	370 gm
Net Weight(N1)	=	Gross Weight – Tare Weight
	=	654 gm – 370 gm
	=	284 gm

Container Number-30

Gross Weight	=	17.215 gm
--------------	---	-----------

$$\text{Tare Weight} = 17.045 \text{ gm}$$

$$\text{Net Weight(N2)} = 0.17 \text{ gm}$$

$$\begin{aligned} \text{Concentration (PPM)} &= \frac{N2}{N1} * 1000000 \\ &= 598.5915 \end{aligned}$$

Bottle Number-252

$$\text{Gross Weight} = 670 \text{ gm}$$

$$\text{Tare Weight} = 372 \text{ gm}$$

$$\begin{aligned} \text{Net Weight(N1)} &= \text{Gross Weight} - \text{Tare Weight} \\ &= 670 \text{ gm} - 372 \text{ gm} \\ &= 298 \text{ gm} \end{aligned}$$

Container Number-60

$$\text{Gross Weight} = 17.024 \text{ gm}$$

$$\text{Tare Weight} = 16.847 \text{ gm}$$

$$\text{Net Weight(N2)} = 0.177 \text{ gm}$$

$$\begin{aligned} \text{Concentration (PPM)} &= \frac{N2}{N1} * 1000000 \\ &= 593.9597 \end{aligned}$$

As we can see, concentration on 16th June is less than that of 15th June. It is because the river water was clearer on 16th June than in 15th June. With the value of concentration in ppm, we know that how fast is sediment being collected into a riverbed.

Learning Opportunities

I had the opportunity to observe the calculation of thickness of sediment by echo machine. We subtract the value obtained by echo machine with the initial thickness of bed. The interactions with experts allowed me to develop deeper into complexities of sediment management, dam operations, and environmental sustainability in hydropower generation. I took advantage of these learning opportunities to ask questions, seek guidance, and discuss best practices with professionals who shared their experience and expertise. This interaction further enhanced my knowledge and enriched my understanding of the field.

Conclusion

The third day of my internship at Marsyangdi Hydropower Station provided continued focus on sediment calculation and dam exploration. Through these tasks, I deepened my understanding of critical aspects of hydropower operations and gained hands-on experience in applying theoretical knowledge to practical scenarios.

17th June 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Internship Report: Fourth Day at Hydropower Station

Today task also same as yesterday's i.e., calculation of sediment.

Sediment Calculation

Calculation:

Date: 17th June 2023

Time: 12:50 PM

Gauge Height: 337.3 m

Sampling Station: Sill-1

Bottle Number-3

Gross Weight	=	710 gm
Tare Weight	=	370 gm
Net Weight(N1)	=	Gross Weight – Tare Weight
	=	710 gm – 370 gm
	=	340 gm

Container Number-58

Gross Weight	=	17.369 gm
Tare Weight	=	17.165 gm
Net Weight(N2)	=	0.204 gm

$$\begin{aligned}\text{Concentration (PPM)} &= \frac{N_2}{N_1} * 1000000 \\ &= 600\end{aligned}$$

Bottle Number-5

$$\begin{aligned}\text{Gross Weight} &= 706 \text{ gm} \\ \text{Tare Weight} &= 370 \text{ gm} \\ \text{Net Weight(N1)} &= \text{Gross Weight} - \text{Tare Weight} \\ &= 706 \text{ gm} - 370 \text{ gm} \\ &= 336 \text{ gm}\end{aligned}$$

Container Number-12

$$\begin{aligned}\text{Gross Weight} &= 16.891 \text{ gm} \\ \text{Tare Weight} &= 16.712 \text{ gm} \\ \text{Net Weight(N2)} &= 0.179 \text{ gm}\end{aligned}$$

$$\begin{aligned}\text{Concentration (PPM)} &= \frac{N_2}{N_1} * 1000000 \\ &= 532.7381\end{aligned}$$

18th June 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Internship Report: Fifth Day at Hydropower Station

Sediment Calculation:

Calculation:

Date: 18th June 2023

Time: 10:00 AM

Gauge Height: 336.9 m

Sampling Station: Sill-1

Bottle Number-252

Gross Weight	=	640 gm
Tare Weight	=	372 gm
Net Weight(N1)	=	Gross Weight – Tare Weight
	=	640 gm – 372 gm
	=	268 gm

Container Number-30

Gross Weight	=	17.630 gm
Tare Weight	=	17.045 gm
Net Weight(N2)	=	0.585 gm

Concentration (PPM)	=	$\frac{N2}{N1} * 1000000$
---------------------	---	---------------------------

$$= 2182.8358$$

Bottle Number-106

$$\text{Gross Weight} = 704 \text{ gm}$$

$$\text{Tare Weight} = 370 \text{ gm}$$

$$\text{Net Weight(N1)} = \text{Gross Weight} - \text{Tare Weight}$$

$$= 704 \text{ gm} - 370 \text{ gm}$$

$$= 334 \text{ gm}$$

Container Number-60

$$\text{Gross Weight} = 18.112 \text{ gm}$$

$$\text{Tare Weight} = 16.847 \text{ gm}$$

$$\text{Net Weight(N2)} = 1.265 \text{ gm}$$

$$\text{Concentration (PPM)} = \frac{N2}{N1} * 1000000$$

$$= 3787.42$$

19th June 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Internship Report: Sixth Day at Hydropower Station

Sediment Calculation:

Calculation:

Date: 19th June 2023

Time: 10:40 AM

Gauge Height: 336.3 m

Sampling Station: Sill-1

Bottle Number-3

Gross Weight	=	690 gm
Tare Weight	=	370 gm
Net Weight(N1)	=	Gross Weight – Tare Weight
	=	690 gm – 370 gm
	=	320 gm

Container Number-12

Gross Weight	=	17.038 gm
Tare Weight	=	16.714 gm
Net Weight(N2)	=	0.324 gm

Concentration (PPM)	=	$\frac{N2}{N1} * 1000000$
---------------------	---	---------------------------

$$= 1012.5$$

Bottle Number-5

$$\begin{aligned} \text{Gross Weight} &= 702 \text{ gm} \\ \text{Tare Weight} &= 370 \text{ gm} \\ \text{Net Weight(N1)} &= \text{Gross Weight} - \text{Tare Weight} \\ &= 702 \text{ gm} - 370 \text{ gm} \\ &= 332 \text{ gm} \end{aligned}$$

Container Number-58

$$\begin{aligned} \text{Gross Weight} &= 17.533 \text{ gm} \\ \text{Tare Weight} &= 17.165 \text{ gm} \\ \text{Net Weight(N2)} &= 0.368 \text{ gm} \end{aligned}$$

$$\begin{aligned} \text{Concentration (PPM)} &= \frac{N2}{N1} * 1000000 \\ &= 1108.43 \end{aligned}$$

Along with calculation of sediment, I was tasked with entering the data from manual log sheet to Excel file. From the data, I got to know about the discharge. Today, the discharge was 408.68 m³/s. We need only 90 m³/s for the production of 69 MW.

Conclusion:

Today internship was very informative and I got more knowledge about hydropower.

10th July 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Title: Eco-Sound Measurement of Sediment Thickness at Marsyangdi Hydropower Station Dam Side: A Field Report

Introduction

This report presents the findings of an eco-sound measurement conducted at the Marsyangdi Hydropower Station Dam Side. The objective was to measure the thickness of sediment settled at the river bottom using a boat-based approach. The operation involved 5 individuals, with safety as a top priority. The eco-sound measurements were taken at the descender of the dam, which diverts river water to the turbine via a tunnel.

Methodology

- a) Boat-Based Approach: A boat was utilized to access different points along the Marsyangdi River for data collection.
- b) Sampling Points: Eco-sound measurements were conducted at 16 different points in the descender area of the dam to capture sediment thickness variations.
- c) Data Collection Team: The team comprised 5 members, with 2 responsible for safely navigating and controlling the boat, while the remaining 3 were in charge of gathering the required data.
- d) Safety Considerations: The safety of all team members was prioritized throughout the operation, with safety equipment, such as life jackets, provided and utilized by the team.

Data Collection Process

- a) Equipment: Specialized eco-sound measurement equipment was used to emit sound waves into the river and measure the time taken for the waves to return, providing information on sediment thickness.

- b) Data Recording: The team recorded the collected data at each of the 16 sampling points, accurately documenting the time taken for the sound waves to reflect back from the riverbed.
- c) Operation Duration: The complete data collection operation lasted approximately 30 minutes, encompassing both the measurements and travel time between sampling points.

Safety Measures

- a) Life Jackets: All team members wore life jackets to ensure personal safety in case of any unforeseen circumstances.
- b) Communication: Clear communication protocols were established among the team members to maintain coordination and promptly address any potential safety concerns that arose during the operation.
- c) Boat Handling Expertise: The two individuals responsible for controlling the boat possessed the necessary skills and training to navigate safely within the river environment.

Results

- a) Sediment Thickness Data: The eco-sound measurements captured sediment thickness at the river bottom in the descender area of the Marsyangdi Hydropower Station Dam Side.
- b) Data Analysis: The collected data will be analyzed to identify sediment distribution patterns and potential areas of concern in relation to sediment thickness.

Conclusion

The eco-sound measurement conducted at the Marsyangdi Hydropower Station Dam Side, specifically in the descender area, successfully gathered data on sediment thickness using a boat-based approach. Safety measures were implemented throughout the operation to ensure the well-being of the team members involved.

10th July 2023

Sheshraman Shrestha

Marsyangdi Hydropower Station

Title: Flushing Operations at Marsyangdi Hydropower Station: A Comprehensive Report

Introduction

The following report provides an overview of the flushing operations conducted at the Marsyangdi Hydropower Station, focusing on the process employed to drain sediment from the reservoir and settling basin. Flushing is a crucial maintenance procedure aimed at preventing damage to the turbine fan and ensuring optimal operation of the hydropower station.

Objective

The primary objective of the flushing operations is to eliminate accumulated sediment from the reservoir and descending basin, reducing the risk of turbine damage and ensuring the efficient functioning of the hydropower station. This report aims to outline the key steps and parameters involved in the flushing process.

Flushing Procedure

a) Timing

The flushing operations at the Marsyangdi Hydropower Station Dam Side were conducted between 2 am and 7 am. This time frame is typically chosen to minimize the impact on power generation and ensure that process can be completed efficiently.

b) Initial Flushing

The flushing procedure commenced by setting the gauge height to 333.00 m, which establishes the desired water level in the reservoir. Subsequently, both flushing gates were opened to a height of 1 m each. This initial gate height

allows for controlled water flow, facilitating the gradual removal of sediment from the reservoir.

c) Gate Adjustment

As the flushing process progressed and the water level reached 330 m, the gate height was raised to 2 m each until they become clear however not more than 3.0 m. The adjustment allows for an increased discharge rate, aiding in the removal of larger sediment particles and debris.

d) Settling Basin Flushing

The flushing procedure commenced by initiating the flushing operations at the settling basin. During it, specific measures were taken to prevent the water from directly touching the gate. This precautionary step aimed to ensure the safety and integrity of the gates while effectively removing sediment from the basin.

e) Main Gate Flushing

Following the completion of the descending basin flushing, the main 5 gates were subjected to flushing. This step ensures the removal of any remaining sediment in the waterway leading to the turbine, minimizing the risk of turbine damage during operation.

Conclusion

Flushing operations are a critical aspect of maintenance at the Marsyangdi Hydropower Station. The efficient removal of sediment from the descending basin and main gates ensures the smooth functioning of the turbine and prevents potential damage to the equipment. The described flushing procedure, including descending basin flushing and main gate flushing, contributes to maintaining optimal performance while minimizing disruption to power generation.

