7

INLAND WATERWAYS

Ever since the beginning, India has been one of the seafaring nations. Its seamen navigated far and near, transporting and widening Indian business and culture. India has a widespread network of inland waterways in the form of rivers, canals, backwaters and creeks. Freight shipping by waterways is extremely underutilised in the country as compared to developed nations. India's hinterland linkage is primarily based to surface and rail with national waterways together with coastal shipping and inland waterways playing a limited role. Waterways are cost efficient and environmentally friendly modes of shipping freight. In India, Inland Water Transport has the potential to alleviate the burden placed on railways and congested surface ways. In addition to commodities movement, IWT division also offers a convenient function in associated activities such as automobiles carriage (Ro-Ro), cross ferries and tourism.

LEARNING OUTCOMES

After studying this lesson the learner:

- defines basic concept of inland waterways;
- identifies various types of Inland waterways;
- lists the port planning and operation of inland waterways;
- identifies the sources of inland waterways;
- predicts opportunities for inland waterways in India..

7.1 INTRODUCTION TO INLAND WATERWAYS

7.1.1 Transportation Management

The beating spirit of almost all businesses is transportation. People, finished goods,

components and raw materials are continuously on the move across towns and cities around the world. These are typically moved by container vessels, cargo planes, cargo trains, trailers of a variety of sizes, and pipelines. Transport generally deals with a) how manufacturers obtain the resources they require to construct their goods b) how merchants obtain the cargoes they require to reserve their shelves in warehouses, and c) how traditional and current internet businesses satisfy their consumers' orders. A Company's ability to marag the practice of constantly transporting cargoes competently and at a resorable prices which can easily make the difference between revenue and peril.

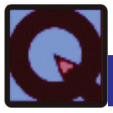
7.1.2 Transport Management in distribution chain management

Many people confuse transportation management with distribution chain management or logistics management. Others fail to recognize how it connects to enterprise resource management. However, transportation administration is neither identical nor entirely separate from these other sophisticated business processes. Transport is the movement of people, cargoes, and related goods from one location to another. Methods of transport comprises air, rail, surface, ocean, cable, pipeline and space. Transport management is important because it enables business among people and industries, which in turn create civilizations. Logistics and distribution chain can be defined to as the art and science of getting and delivering objects and cargo in the appropriate place and correct quantities. This definition comprises inbound as well as outbound progress. One of the most important factors, in both import and export trade, is a reliable logistics firm. When a firm needs to shift their cargoes to a regional or worldwide destination, these logistics firms are competent in offering the finest and the quickest method. They make sure that a firm reaches its final point on time without any damage.

7.1.3 Waterways

A waterway is a navigable body of water and an essential part of human activity. The reason is that during the times of prehistoric times and navigability it has permitted watercraft and canals to pass through every body of water. Having wide variety of waterways characteristics on Europe makes this category valuable for respectly the various classes of waterways. There is also a remarkable diversity of waterway characteristics in several countries of Asia, but there has not been any equivalent international drive for uniformity. Water transport in India has played a significant role in the nation's overall economy and is indispensable to foreign trade. India is endowed with a considerable network of waterways in the form of rivers, canals, backwaters, creeks and a long coastline accessible through the seas and oceans. It has the largest carrying capacity of any form of transport and is the most suitable method for carrying heavy

cargoes over long distances. It is one of the most economical modes of transport in India, as it takes advantage of natural tracks and does not require a huge capital investment in construction and maintenance except for canals. Its fuel effectiveness lowers operating costs and reducing the environmental impact due to carbon. India is surrounded by nearly 14500 km of inland waterways. Out of which only 5685 km are navigable by embattled vessels. Its vision is to increase the current cargo handling capacity from 55 MT in 2017-18 and 72 MT in 2018–19 to 100 MT by 2021–22 of India's 111 national waterways.



INTEXT QUESTIONS 7.1

1. _____is referred to as the movement of people, cargo, and related goods from one location to another.

2. A _____ is referred as a navigable of water and an essential part of human activity.

3. Transport methods comprise air, rail, surface, ocean, cable, pipeline as well as _____.

4. India is surrounded by nearly _____ km of inland waterways.

7.2 MEANING OF INLAND WATER

The term "inland waterway" was introduced to navigable rivers and canals and was intended for inland waterway vessels, which were was implied to have much smaller dimensions than seagoing ships. An inland waterway is a system in the form of rivers, canals, backwaters and creeks. It can be used for transportation instead of or in addition to roads and rails. Through the ages, rivers have served as adequate waterways, carrying people and goods over long distances. All of those waters such as lakes, canals, rivers, watercourses, inlets, and bays which are situated within the province of a state are contrasted with the open oceans or marginal waters bordering other states are subject to several sovereign rights of the bordering state. The interior of the water does not border upon the marginal or high oceans or is above the tide rise and fall. India has an extensive structure of inland waterways in the form of rivers, canals, backwaters and creeks. There are14,500 km (9,000 mi) of navigable structure, out of which about 5,200 km (3,200 mi) of river and 4,000 km (2,500 mi) of canal.

About 44 million tonnes (49,000,000 short tons) of cargo are moved annually through these waterways using embattled vessels and country boats. Further, these cargoes are

transported in a systematic manner confined to a few waterways in Goa, West Bengal, Assam and Kerala. Inland waterways comprise of the Ganges – Bhagirathi – Hooghly Rivers, the Brahmaputra, the Barak River, the rivers in Goa, the backwaters in Kerala, indian waters in Mumbai and the deltaic part of the Godavari – Krishna rivers.

Inland waterways have played a central role in maritime development in India. Moreover, according to The National Waterways Act 2016, it has declared 111 river stretches, creeks, estuaries in India as National Waterways. Navigation in rivers, lakes and other water bodies by small vessels connecting places not far from each other has been around for centuries. It has been the backbone of our inland waterways. In a few cases, especially near ports and coastal areas, this has also become large-scale, commercial shipping.

INTEXT QUESTIONS 7.2

1. An inland waterway is a system in the form of _____.
2. The National Waterways Act _____, it has declared 111 rivers, creeks, estuaries in India as National Waterways.
3. Through the ages, _____ have served as adequate waterways, carrying people and goods over long distances.
4. India has an extensive structure of inland waterways in the form of rivers, canals, backwaters and _____.

7.3 TYPES OF INLAND WATERWAYS

There are three types of inland waterways, namely rivers, rivers altered or canalised, and specially constructed canals.

A. **Rivers:** The rivers of our nation play a significant role in the lives of the Indian people and industries. The river systems provide irrigation, potable water, economical transportation, electricity, and offer livelihoods for a large number of groups all over the nation. This explains why the major is located the river banks. In Hindu myth rivers, the rivers play a significant role and are considered holy in the nation.

B. **Seven Major Rivers:** The major rivers such as Indus, Brahmaputra, Narmada, Tapi, Godavari, Krishna and Mahanadi) along with their numerous tributaries

make up the river system of India. Further, most of these rivers flow towards the Bay of Bengal. Few of the rivers move towards the western part of the nation and lead east of the state and become empty in and empty. The Ladakh parts situated in northern areas of the Aravalli range and the arid sectors of the Thar Desert, have inland drainage. All these eminent rivers of India generally originate from any of the three main watersheds. India's rivers can be classified by their origin and basin type.

Table 7.1: **Rivers of India**

Code	Basin Name
1	Indus (Up to border)
2a	Ganga
2b	Brahmaputra
2b	Barak and others
3	Godavari
4	Krishna
5	Cauvery
6	Subernarekha
7	Brahmani and Baitarni
8	Mahanadi
9	Pennar
10	Mahi
11	Sabarmati
12	Narmada
13	Tapi
14	West flowing rivers South of Tapi
15	East flowing rivers between Mahanadi and Godavari
16	East flowing rivers between Godavari and Krishna

17	East flowing rivers between Krishna and Pennar
18	East flowing rivers between Pennar and Cauvery
19	East flowing rivers South of Cauvery
20	West flowing rivers of Kutch and Saurashtra including Luni
21	Minor rivers draining into Bangladesh
22	Minor rivers draining into Myanmar
23	Area of North Ladakh not draining into Indus
24	Drainage Area of Andaman & Nicobar Islands
25	Drainage Area of Lakshadweep Islands

In earlier times, most of the inland transportation of commodities took place by water. This was occused becouse the vessels were small, the volume traffic limited, and the time factor was not particularly demanding. But during the 18th century, ships began to grow in size, trade developed and expanded, and the speed of carriage also became to be of greater importance. In general, canals were built to overcome river restrictions and also to provide many inland cities with water communications. In countries like England, which is familiar with canal construction, the structures of these innovative man-made waterways have become almost a mania. Though the concept of building the canal in the Continent arrived somewhat later, there few examples of canals built early, e.g., in develpment 1681, the Canal du Midi was constructed in southern France.

Due to railways and road transport, there was a downfall in inland sea transport during the 19th century. However after a few decades, the ocean transport has tended to make a comeback, because it is connected with the economical and capacity of carrying bulk goods. In addition, the ocean transport industry had witnessed the developments of the canal Albert, the connecting between Zeebrugge and Ghent, and the canalisation the Moselle, the Rhone Valley scheme, as well as other developments.

C. Inland waterways in Asia

Asia's inland waterways and as follows:

a. **Asia:** Generally, Asia does not have a stretched structure of inland waterways, but in several nations, rivers are utilized as inland waterways.

b. **China:** The Rivers have constructed an irreplaceable dedication to the development of business. The three eminent rivers, the Hwang-ho, the Yang-tse-kiang and the Sikiang, move the nation from west to east. The river Yang-tse-kiang is China's supreme river, the most important waterway for navigation in the nation. In China, nearly half of the populations lives in this fertile location and use this river. It has a network of canals which are the main mode of communication in Tibet, and with its tributaries finally drains the heart of China. Moreover, steamers route it upto Hankow. The river Sikiang which rises in the highlands is quite direct towards its mouth. It is stretched towards the crider area and Pei-ho is significant for communication and can be moved up to Tientsin.

D. Northern India

The northern part of India is well endowed with three major navigable rivers.

a. **Ganga:** It is navigated by steamers till Kanpur from its origin. In addition , it floows towards the nation's most fertile and densely populated plain. Earlier, it was used ato transport cargoes and move people. Later on the growth of Indian railways has greatly reduceds the significance of steam navigation, particularly in the upper tier. Moreover, there is traffic all the time on the Lower Ganga and it is still seen as very imperative.

b. **The Brahmaputra:** The Brahmaputra flows towards the state of Assam and our neighbour nation Bangladesh. It is routed till Dibrugarh and its tributaries the Surma, which has made steam navigation possible in Sylhet and Cachar.

c. **The Indus:** The Indus flows from Pakistan and is navigable by steamer towards the Dera Ismail Khan in the area of North Western Frontier. This river is primarily used to trasport commodities such as wheat, cotton and wool. The regular movement of its bed and the structure of sand-bars has created steam navigation in the Indus river, which has been ignored.

d. **Burma:** This nation is very lucky in having a huge number of navigable rivers. The river Irrawaddy, which is the most significant and the biggest, is navigable by steamer agents for more than 800 km from its origin. Nation boats can move further.

E. Development of National Waterways

With over 111 waterways (mean 5 existing waterways and 106 new waterways) declared

as National Waterways (NWs) under the National Waterways Act of 2016, which came into force in the year 2016, 12th April 2016 the nation & trying to develop its inland water transportations.

Table 7.2: **Operational National Waterways in the Country**

S. No.	National Waterway Number	Location	Length(Km)
1	**NW-1:** Ganga-Bhagirathi-Hooghly River System (Haldia - Allahabad)	Uttar Pradesh, Bihar, Jharkhand,West Bengal	1620
2	**NW-2**: Brahmaputra River (Dhubri - Sadiya)	Assam	891
3	**NW-3**: West Coast Canal (Kottapuram- Kollam), Champakara and Udyogamandal, Canals	Kerala	205
4	**NW-4:** Phase-1 development of the stretch Muktiyala to Vijyawada of river Krishna	Andhra Pradesh	82
5	**NW-10** (Amba River) **NW-83** (Rajpuri Creek) **NW-85** (Revdanda Creek - Kundalika River System) **NW-91** (Shastri river–Jaigad creek system)	Maharashtra	45 31 31 52
6	**NW-68 – Mandovi** – Usgaon Bridge to Arabian Sea **NW-111 – Zuari**– Sanvordem Bridge to Mormugao Port	Goa	41 50
7	**NW-73- Narmada river** **NW-100- Tapi river**	Gujarat & Maharashtra	226 436
8	**(NW-97):** Namkhana to AtharaBankiKhal	West Bengal	172

INTEXT QUESTIONS 7.3

1. There are _____ types of inland waterways.
2. The Brahmaputra flows towards the state of _____ and our neighbour nation Bangladesh.
3. The _____ flows from Pakistan are navigable by steamer towards the Dera Ismail Khan in the area of North Western Frontier.
4. In general, _____ were begun to be built in order to overcome the restrictions of several rivers.

7.4 BENEFITS OF INLAND WATERWAYS

A. The chief merits are:

- There is no need for any track to lay or to maintain such routes, though dredging may be essential in the instance of natural waterways;
- They may offer the only practicable routing system;
- Waterways, under constructive conditions, offer economical transport for commodities such as coal, ore, and timber, cement which is heavy, bulky and imperishable in nature.

B. Other Merits

- Saving of Costs
- It is fuel and energy effective when compared to the other forms of transport.
- The cost of developing waterways is lower.
- Decreases the transportation and transition losses.
- Eco-Friendly.
- Low fuel utilisation per tonnekm.
- For trucks the emission of Carbon dioxide emission is 50%.
- No need of land required.
- Supplementary form of transport.

Notes

- Reduces pressure on road and rail
- Reduces congestion and accidents on road
- It will offer optimal modal combinations covering ocean transport with modes.
- Superior connectivity**:** It creates seamless interconnectivity linking hinterlands besides navigable river coasts and coastal paths.
- Inland waterways holds tremendous potential for domestic goods transport, cruise services, tourism and passenger traffic.
- Growth of inland waterways will help create of employment opportunities.
- It symbolises a built in infrastructure network, which can be implenorted without any additional capital investment.
- Congestion is reduced, there by reducing congestion on highways shifting goods away.
- Waterways do notinvolve land acquisition challenges.
- Waterways are an economical form of transportation vis-à-vis the available options, significantly decreasing cargo transportation prices.

7.4.1 Demerits of Inland Waterways

- Rivers may entail devious routes and may stream in the wrong direction from the point of view of business;
- The navigable rivers may be interrupted by falls while canals need locks if there is variation in stages;
- River phase may vary seasonally and glacial might take place in winter creating closure in navigation;
- Canal construction comprises of heavy capital expenditure and canals need regular maintenance and at times to be dredged, and also need a water supply;
- Shipping by water is slow in recognition with most other methods of overland movement and carriage by water is normally unsuitable for fragile produce; and
- As being less adjustable in nature, it cannot simply adapt them to altering industrial areas.

Even though water transport is moved on to a greater or lesser grade the world over, there are only six main navigable structures of inland waterways

1.The rivers of western and Central Europe 2.The Volga-Don system 3.The North American rivers 4.The Amazon system 5.The Parana-Paraguay system, and 6.The Chinese waterways. In Europe and North America these inland waterways are the most developed whereas on other continents their progress is moderate.

INTEXT QUESTIONS 7.4

1. Growth of inland waterways will create_____opportunities.
2. The best way to improve inland waterways in Europe and _____.
3. Navigable rivers may be interrupted by falls while canals need locks if stages vary.
4. River phase may vary seasonally and glacial activity may occur in the winter creating closure in navigation

7.5 SCOPE OF INLAND WATERWAYS

India is gifted with several Inland Water Transport (IWT) alternatives that consist of rivers, canals, backwaters, creeks, and tidal inlets. India's share of cargo moved on inland waterways has the potential to increase when compared to other modes. It is important to increase the share of the nation's inland waterways as they are a cost-effective and environmently friendly form of transport. Over the last five years our nation has increased the modal share of goods from 0.5 per cent to 2 per cent and has observed 19 per cent continuous year growth in goods volumes. Our nation is developing of nearly 5,000 kms of navigable inland waterways. These not only form a competitive choice form of transportation with 30 % less operating charges by railways and 60 % lower than road transport but it is also a sustainable method in cargo logistics as well as passenger transport. To develop and regulate inland waterways, in 1986, the Inland Waterways Authority of India (IWAI) was established.

The Indian government had notified 106 as added waterways as National Waterways by the Act of National Waterways but among all only five waterways acknowledged as National Waterways (NWs). Out of these 111 NWs spotlighted under the Act, several ways are operational for activities such as shipping, navigation of goods and passenger vessels and functions on those routes.

A. National Waterway-1 (Ganga-Bhagirathi-Hooghly river structure from Allahabad to Haldia),

B. National Waterway–2 (River Brahmaputra from Dhubri towards Sadiya),

C. National Waterway-3 (West Coast Canal from Kottapuram towards Kollam besides Udyogmandal and Champakara Canals) which has already been developed and equipped with fairways, navigational aids, jetties and terminals with automated equipment and handling amenities for stuffing and de-stuffing of cargo. In addition to NWs notification, the government has also taken steps to acceterate infrastructure growth.

These comprises are:

- Jal Marg Vikas Project (JMVP) for NW-1.
- Arth Ganga and Arth Brahmaputra for holistic and sustainable growth leveraging NW-1 and NW-2 for goods and passenger movement.
- Inland Vessels invoice.
- Utilisation of land guidelines for Inland Waterways (IWs).
- Dredging strategy for IWs.
- Encouraging private involvement in terminal execution and maintenance.

As a result, the total goods volume shipped through inland waterways in India attained 73.6 million tons per annum (MTPA) in 2019-20 and grew at a CAGR of 19 per cent over the past five years. Key factors contributing to this sector's growth are the availability of limited infrastructure, lack of inland vessels and non-availability of return goods. Further move governance problems due to overlapping authorities also drastically showed sector progress. Once seamlessly incorporated with other modes of transport, together with the coastal intrastructure, IWT can offer significant relief to congestion on the surface infrastructure. At present it not only functions as a supplementing method of transportation, but has influential perspectives in river and canal tourism; however, it should be tapped and identified its real potential. In order to deal with the above problems and further to move the goods and passenger through IWs, four sectors have been recognized.

1. Enhancement and growth of infrastructure at 23 major NWs

A stage wise strategy to enhance terminal and associated infrastructure among 10 functional NWs by 2025 has been created. Additionally 6 NWs that will be functional under the authority of state maritime boards have also been shortlisted for infrastructure

enhancement. Seven upcoming NWs which have the potential to unlock 13-15 MTPA of goods capacities have also been recognized for growth on priority basis. The preliminary works towards development are expected to be finished by 2024. In order to failitate the goods movement among NWs various demand activation deals are also proposed.

2. Provincial linkage with Bangladesh, Nepal, Myanmar and Bhutan

Besides the NWs under development, NW-1 and NW-2 hold enormous importance as they link the neighbouring nations with India's hinterland. EXIM with nations like as Bangladesh, Bhutan, Myanmar and Nepal could benefit from these waterways.

A. **Bangladesh:** Currently movement between India & Bangladesh takes place under the Indo-Bangladesh Protocol on Inland Water in Transit and Trade agreement which associates NW-1, NW-2, NW-16 and NW-97. Under this Protocol, inland vessels of both countries can play on the appropriate protocol route and dock at Ports of Call in each country, advised for loading/ unloading of cargo. There has been significant improvement in the movement of cargo vessels in a coordinated manner on the protocol route carrying both transit cargo to northeast region and vice-versa and export-cargo to Bangladesh.

B. **Nepal:** The development of NW-1 from Varanasi to Halide/Sager under the Jal Marg Vikas Project (JMVP) has also opened up opportunities for transportation of Nepalese cargo to/from third countries via Kolkata Port using NW-1. Considering the availability and understanding of IWT mode for hinterland transportation, India and Nepal have defined Inland Waterways mode in the Treaty of Trade and Transit between the two countries.

C. **Myanmar:** The Kaladan Multimodal Transit Transport Project has been conceptualised by the ministry of external affairs (MEA) to provide alternative connectivity to the northeast region of India with the Kolkata port and the rest part of the country. The venture envisages a link between Haldia/Kolkata in West Bengal via an ocean route till Sittwe (539 km) in Myanmar. Further, via Inland Water shipping till Paletwa (158 km) and by surface from Paletwa towards the Indo–Myanmar Border till Mizoram (110 km). Phase-1 of the similar work has been already been accomplished under the growth rules.

D. **Bhutan:** The Inland Waterways connectivity through the Indo-Bangladesh Protocol (IBP) is of significant significance for Bhutan. As per the contract on business and journey between India and Bhutan, Dhubri on NW-2 is declared as an approved exit/ entry position in India for EXIM goods movement of Bhutan.

3. Development of terminal infrastructure for Ro-Ro and ferry services

The ability to move people and cargo seamlessly and cost effectively from originating point to destination is a key driver for growth and jobs. IWs could play a significant role in lowering the burden of transportation, making India's logistics more competitive. Currently, 145 million passengers are ferried between the nine states and the highest share is West Bengal accounts first, followed by Kerala and Maharashtra. The main success feature in the uptake of ferry services is structure mixture with other modes of transport and ensuring first and last mile connectivity. Globally, several countries like Australia, Norway, and Hong Kong have undertaken measures to integrate their ferry systems with other modes of transport. In Kochi, a single smart card has been used to connect ferry boat services to the Kochi Metro.

4. Policy interventions to incentivize development of the IWT sector

In order to encourage the uptake of IWT, the government needs to provide fiscal benefits to the operators and users. Reduction in taxes, removal of tax deviation, and flexibility in operations could act as an incentive to shift traffic from road/rail to IWT. Related measures have been undertaken in Europe to encourage the use of IWs.

A. **The way ahead:** India has prioritised development of 23 NWs in the next 10 years, which are expected to increase goods traffic. A set of globally benchmarked targets have been defined as part of MV 2030, to incruse inland waterway traffic and improve the performance of the sector. In this lesson specific initiatives and a lesson by lesson road map will further and in achieving the set Key Performance Indicators (KPIs). With the suggested measures, share IWT can increase from 2 per cent at present to 5 per cent by 2030.

INTEXT QUESTIONS 7.5

1. The Inland Waterways Authority of India (IWAI) was established in the year_____.

2. MTPA stands for _____.

3. Globally, several countries like Australia, Norway, and Hong Kong have undertaken measures to integrate their _____ systems with other modes of transport.

4. Reduction in _____ removal of tax deviations and operations flexibility could act as an incentive to shift traffic from road/rail to IWT.

7.6 SOURCES OF INLAND WATERWAYS

Inland waters are distributed among polar ice and glaciers, cordially exchanged groundwater, freshwater lakes, and human-made impoundments (farm ponds and reservoirs), saline lakes, soil water, marshes/wetlands, and rivers and streams, in decreasing volume. 1. Polar ice and glaciers 2. actively exchanged groundwater 3. freshwater lakes 4. human-made impoundments (farm ponds and reservoirs) 5. saline lakes 6. soil water 7. marshes/wetlands 8. rivers and streams

1. **Polar ice and glaciers:** The Himalayan region of India is home to some of the most evident glaciers in the world including Siachen Glacier, the second largest glacier on earth and largest in the Himalayas. The following list of the most significant glaciers in India. Most glaciers are situated in the province of Ladakh, surrounded by the states of Sikkim, Himachal Pradesh and Uttarakhand. Some glaciers one also found in Arunachal Pradesh.

7.6.1 SOURCES OF INLAND WATERWAYS (basis of origin)

The main sources of water in India on the basis of origin are as follows

A. **Himalayan Rivers:** The main Himalayan river systems are the Ganga. The Indus and the Brahmaputra rivers system. The Himalayan Rivers form large basins. Many rivers pass through the Himalayas. These in-depth valleys with vertical rock sides were created by the down cutting of the stream during the time of the Himalayan uplift. They carry out intense erosion movement up the streams and hold massive loads of sand and silt towards the plains, river cliffs as well as levees. These rivers are constant as they receive water from the rainfall and by melting of ice. Almost all of them construct massive plains and are navigable over the long distance. Moreover, these rivers are also connected with their upstream catchment location to produce hydroelectricity.

B. **Peninsular Rivers:** The major peninsular river structures comprising are 1. The Narmada 2. The Tapi 3. The Godavari 4. The Krishna, and 5. The Mahanadi Rivers. The rivers such as the Peninsular Rivers move towards the shallow valleys. A huge number of them are seasonal in nature as their stream is mostly dependent on rainfall. The purpose of erosion movement is also relatively less because of the general slope. The rock bed which is hard and a short of silt and sand which does not permit any important meandering. Many rivers therefore have straight and linear cause. These rivers provide huge opportunities for hydroelectric power.

C. **The Indus River System:** The origin of Indus lies in the northern slopes of the

Kailash series in Tibet adjacent to Lake Manasarovar. It follows a north westerly course through Tibet. It penetrates towards the Indian border in Jammu and Kashmir and it creates a pleasing gorge in this location. Quite a number of tributaries such as the Zaskar, the Shyok, the Nubra as well as the Hunza unite it in the Kashmir province. It comes via the areas of Ladakh, Baltistn and Gilgit and crosses the Ladakh Range as well as the range of Zaskar. It passes through the Himalayas with a 5181 m in depth gorge adjacent to Attock. Iying north of the Nanga Parbat after that it takes a curve to the south west route before moving towards Pakistan. Both India and Pakistan are surrounded with a huge number of tributaries with an entire length of around 2897 km from the origin to the location of near Karachi where it finally enters into the Arabian Sea. The Jhelum, Chenab, Ravi, Beas and Sutlej are the foremost tributaries of the Indus in India.

D. **Jhelum:** From the south – eastern area of Kashmir ,the Jhelum originates, and. it moves towards the Wular Lake, which located in the north, and next towards Baramulla. Further, it moves towards an in depth gorge cut by the river Pir Panjal which located among Baramulla and Muzaffarabad.The right bank stream, the Kishanganga unites at Muzaffarabad. It moves towards the Indo – Pakistan territory and flows towards the plains such as Punjan, and at the end connect the Chenab at Trimmu.

E. **Chenab:** The River Chenab takes its birth from both rivers, such as the Chandra as well as the Bhaga, which these two originate from the BaraLacha Pass located in Lahaul. In Himachal Pradesh, it is also referred as the Chandranhaga. It moves parallel towards the Pir Panjal area in the north westerly route and bends via the location adjacent to Kishtwar. It penetrates the plains of Punjab adjacent to Akhnoor and after that it unites the Jhelum. Further it is connected by the Ravi as well as the Sutlej in Pakistan.

F. **Ravi:** The River Ravi commence adjacent to the Rotangand moves in the Kangra Himalayas and go after a north westerly course. It then bends to the south west, adjacent to Dalhousie, and then turns a gorge in the Dhauladhar area penetrating the plains in Punjab plain which is close to Madhopur. It moves as a division of the Indo – Pakistan territory for quite a distance before penetrating the Pakistan and uniting the river Chenab. The entire length of the river stretches around 710 km.

G. **Beas:** The River Beas begins from Beas Kund, located adjacent to the Rohtang pass. It moves past Manali as well as Kulu, where the gorgeous valley is referred to as the Kulu. It initially moves a North West route from the town of Mandi and next it moves towards a westerly path, before penetrating the plains of Punjab which is

close to Mirthal. It unites the river Sutlej adjacent to Harika, after which it unites with few tributaries. The entire length of the river is approximately 615 km.

H. Sutlej: The Sutlej originates from the Rakas Lake, which is connected to the Manasarovar Lake by a stream, in Tibet. It moves on a north wester ndiration and enters. Himachal Pradesh at the Shipki Pass, where it is joined by the river Spiti. It cuts deep gorges in the range of the Himalayas, and finally enters the Punjab plain after cutting a gorge in a hill range, the Naina Devi Dhar. This where the dam Bhakra Dam which has a huge water reservoir called Gobind Sagar, has been built. It bends west below the river Rupar and is later joined by the Beas. In this way, Pakistan moves adjacent to Sulemanki and is further connected by the Chenab. It has an entire length of approximately 1500 km.

I. The Structure of Brahmaputra River: The Brahmaputra takes birth in the lake Mansarovar which is also the main source of the Indus and the Satluj. It is longer them the Indus, but the majority of its course is located outside India. It streams eastward, similar to the Himalayas and it reaches the area of Namcha Barwa (7757 m) and takes a cut around it and penetrates India in the state of Arunachal Pradesh and is called dihang. The u-turn made by this particular river is around 5500 metres. In India, it moves towards states such as Arunachal Pradesh, Assam, and is united by many tributaries. This river is called the Tsangpo in Tibet where it obtains less water and silt. As it of day a province with heavy rainfall the river carries a huge amount rainfall. The Brahmaputra is surrounded by a braided canal most of its length in the state of Assam. It has a few huge islands surrounded by the channel. The shifting of river direction is also extremely common. The river flow during of Assam and our adjacent nation Bangladesh.

J. The Structure of Narmada River: The River Narmada is located in the central part of India. It creates the customary boundary between North and South India, and is surrounded by 1289 km (801 mi) long. Out of the foremost peninsular rivers in India, Narmada, Tapti and Mahi function from east towards the west. It grows on the top of Amarkantak Hill which is located in the state of Madhya Pradesh for the first 320 kilometres (200 miles) of its route winds between the Mandla Hills, which creates the chief of the Satpura area: Jabalpur, which moves towards the 'Marble Rocks'. Further it penetrates the Narmada Valley linking the Vindhya and Satpura areas, and follows a straight westerly route towards the Gulf of Cambay with a length of 1312 kilometres (815 miles). It moves through three states such as Madhya Pradesh, Maharashtra and Gujarat, and it unites into the Arabian Sea towards the Bharuch district of Gujarat.

K. The Tapi River System: The River Tapi is located in central India. It is considered as one of the familiar rivers of peninsular with the total length of approximately 724 km, which passes through east to west. It begins in the eastern part of Satpura area of southern part of Madhya Pradesh, and arrives slowly in westward, draining towards the historic Nimar region Madhya Pradesh's, historic Khandesh of Maharashtra's and east Vidarbha locations in the northwest curve of the Deccan flat terrain and moves to South Gujarat before joining into the Gulf of Cambay,Arabian Sea,of Gujarat. The Western Ghats route begins from south of the river Tapti adjacent towards the border of states of Gujarat and Maharashtra.

The Basin Tapi River located mainly in the state of Maharashtra's northern and eastern districts through Amravati, Akola, Buldhana, Washim, Jalgaon, Dhule, Nandurbar, Malegaon, and district of Nashik and further moves towards Betual, Burhanpur districts of Madhya Pradesh and later enters Surat district in Gujarat as well. The principal stream of rivers of Tapi are Purna River, Girna River, Panzara River, Waghur River, Bori River and Aner River.

L. The Structure of Godavari River: The Godavari is often referred as the Vriddh or the Dakshine and it is the second largest river route in India. As the river moves towards the route of Ganga's tragedy, the name might be apt in several ways. The river's total length is around 1,450 km (900 miles) and it starts at Trimbakeshwar, close to Nasik and Mumbai in Maharashtra which is approximately 380 km distance from the Arabian Sea, but stream towards the southeast towards south part of central India through different states such as Madhya Pradesh, Karnataka, Orissa , Andhra Pradesh and at end unites into the Bay of Bengal. The river divides into two streams thus creating an extremely fertile delta at the place called Rajahmundry, which is 80 km from the coast. The banks of this river also have several pilgrimage sites similar to other major rivers in India, for example, Nasik, Triyambak and Bhadrachalam, which are considered as the major ones. Being brownish in nature, this river is seasonal in nature because it stretches during the monsoons and becomes dry at the time of summers. Few of its tributaries consists of Indravati River, Pranahita (mixture of Penuganga and Warde), Manjira, Bindusara as well as Sabari. Few significant urban centres on its banks comprises Nasik, Bhadrachalam, Rajahmundry as well as Narsapur. Asia's biggest rail cum surface bridge on the river Godavari connecting Kovvur and Rajahmundry is referred to as an engineering feat.

M. The Structure of Krishna River: The River Krishna is considered as one of the longest rivers of India with approximately 1300 km in length. It originates in Maharashtra at the palace Mahabaleshwar and moves via Sangli and gathers the sea at Hamsaladeevi, Andhra Pradesh in the Bay of Bengal. This moves via the

states of Maharashtra, Karnataka as well as Andhra Pradesh. The customary source of the river comes from the mouth of a sculpture of a cow in the ancient holy place of Mahadev in Mahabaleshwar. Its most significant stream is the river Tungabhadra, which itself is created by the rivers Tunga and Bhadra which originate in the Western Ghats. Other streams are the Ghataprabha, Kouna, Musi, Bhima, Mallaprabha, Yerla, Warna, Dindi, and Dudhganga .

N. The Structure of Kaveri River: The Kaveri which is spelled Cauvery or Kavery is considered as one of the huge rivers of India and. This is also referred to as Dakshin Ganga. The main headwaters are situated in the Western Ghats series of the state of Karnataka State and it moves towards Tamil Nadu, It finally joins hands with the Bay of Bengal. This water has been supporting irrigated agriculture for centuries, and it has been the livelihood of the prehistoric kingdoms and current towns of South India. The main source of the river is at Talakaveri, situated in the Western Ghats which is approximately 5000 feet (1500 m) above sea point. Talakaveri is a renowned pilgrimage and tourist location set in the Brahmagiri Hills close to Madikeri in Kodagu locality of Karnataka. Thousands of devotees march towards the temple at the source of the river particularly on the particular day referred as Tula sankramana when the river has been viewed to flood out like a spring at a determined time. It streams normally south and east for approximately 765 km, and joins hands with the Bay of Bengal via two major mouths. Its basin is anticipated to be 27,700 square miles (71,700 km), and it has several streams comprising rivers such as Bhavani,Shimsha, Hemavati, Lakshmana Tirtha, Arkavathy, Kapila, Honnuhole, Kabini, Lokapavani, Noyyal and eminent Amaravati.

O. The Structure of Mahanadi River: The river Mahanadi is a part of eastern India. The Mahanadi originates in the Satpura series of central India, and moves towards the east of Bay of Bengal. Further this river drains most of Chhattisgarh and Orissa and also passes towards Jharkhand and Maharashtra. It consists of a length which is approximately 860 km.

INTEXT QUESTIONS 7.6

1. The main Himalayan river systems are the_____.
2. The origin of the Indus lies in the northern slopes of the_____.
3. The rivers such as the Peninsular Rivers move towards the _____ valleys.
4. The river Mahanadi is a part of _____ India.

7.7 ISSUES, CHALLENGES AND WAY FORWARD OF INLANDS WATERWAYS

1. Issues and Challenges

A. Estimation charges: In connection of operating charges per ton-km, IWT has lower charges than cargo train and road modes. This is howeves, a Nevertheless, in the chargs. There exist two features which evaluate how freight moves on surface versus on ocean: i) A surface journey is straight while oceans bend and curve; hence the change among freight charges for IWT and surface / railways is not much ii) Charges of freight related to stuffing and de-stuffing

B. Insufficient depth: To be considered a navigable inland route it, needs adequate depth the year. Nevertheless, in their normal state, several Indian riverlack the level of water which requires widespread dredging. Besides, Indian rivers (particularly rivers located in the northern plains) face severe issues siltation through the year

C. Force on other activities: Comprising dams and farming, water in rivers has a forceful demands. It may be necessary to restrict the use of water for such other activities in order to maintain the water levels on the said rivers so that they will operate as inland waterways.

D. Insufficient Air Draft: Numerous bridges with less vertical clearance might hinder the passage of superior inland water transport ships on several inland waterways such as NW 3.

E. Lack of night navigation: Night navigational services and markings are also a major problem.

F. Lack of IWT ships: Ship building is extremely capital intensive and faces difficulties in obtaining venture finance from banks and other financial Organisations.

G. Scarcity of MRO amenities: There is a severe scarcity of Maintenance, Repair and Revision (MRO) amenities for IWT ships.

H. Insufficient industries: Insufficient number of manufacturing units on the riverside, particularly not all along the Brahmaputra is a main discouragement holding back inland waterways growth. At the National Strategy Dialogue on trans-boundary collaboration connected to the rivers of Ganga and the Brahmaputra, it was highlighted that due to insufficient manufacturing capacity, there is no commitment by private agents.

I. Insufficient funds: The process of dredging and infrastructure for IWT need enormous investments. The funding for this sector from the public and private source appears to be very low.

J. Ecological Impact:

a. The operations of dredging will harm river beds, and can direct and alter habitats for diverse aquatic flora and fauna.

b. Further this dredging might also force aquifers along the river, there by reducing the ability of water to percolate underground.

c. During capital dredging, the removal of river bed substence can cause surplus saline water to enter rivers or estuaries. This is one of the reasons why the Kerala government opposed several of its propased waterways.

d. The building of jetties and river ports will lead to removal of trees/ mangrove forests in the location. For instance, at the port Dharamtar which is in NW10, for building a jetty, the mangrove forest area on the bank has been removed.

e. Other ecological matters include pollution owing to oil and diesel from ships, leakage and spilling of goods.

Note: Dredging is an activity of digging underwater which removes rock, mud, silt, sediments etc. Dredging is used to create a canal in the river bed of the required depth.

K. Social impact:

a. Ecological forces can end the livelihoods of people or industries who rely on the rivers and streams. For instance: impact on fishing groups of people, mainly relying on riverbeds cultivation.

b. Dislocation is another major concern as land is required for amenities like ports, jetties, and other related infrastructure.

c. Collaborating with public-private joint ventures has the main role to play in the growth of the inland waterways division. Private sectors can initiate terminal development, goods and passenger handling, and less-draft ships and related repair amenities.

d. Certain measures should be taken for the development of basic infrastructure,

which address sophisticated technological blockage and preservation of rivers to ensure year-round navigability.

e. To create the availability of flawless, multimodal last-mile links to and from the surrounding area to decrease trans-shipment charges and make inland water transport cost -effective.

f. Consignment transport via inland waterways should also be incentivized. For this reason, the following measures can be taken into consideration :

g. To utilise this form for a portion of their consignments, the respective Government can mandate or incentivize these units in the vicinity of national waterways.

h. The government can support manufacturing corridors besides the riverbanks and promote waterways- related industrialization.

i. High road taxes can be imposed on shipping of coal and inflammable substances over longs distances.

j. The government should focus on the development of passenger terminals, provide financial assistance to ferry operators to enhance the safety, and assist insurance coverage in order to improve passenger transport.

k. In states such as Assam and Kerala certain measures should be taken to encourage river tourism.

l. Bearing in mind the concerns, it is imperative to assess the ecological and social impact of growth of inland waterways and related infrastructure to negate possible damage.

L. Other Implementation Challenges

a. The canal draft of the national waterways is not at standard level at 2 metres throughout the year, as is needed. Few of these streams are seasonal in nature and do not provide navigability throughout the year. Approximately 20 out of the 111 reliable national waterways have apparently been found not feasible.

b. In addition, all the recognized waterways rely upon rigorous capital and maintenance dredging, which could be opposed by the domestic community on ecological grounds, comprising dislocation fears, thereby creating execution challenges. Moreover, these water resources have significant competing uses,

viz. required for living, irrigation, and power creation etc. It would not be feasible for the state government/others to overlook these requirements.

c. The exclusive authority of the Central Government is merely in connection to transportation and navigation on inland waterways which was acknowledged to be 'national waterways' by an act of Indian Parliament. In other waterways that are surrounded by the parallel list or under the authority of stage governments, ships can be used or sailed.

d. As each revering structure is unique and provides varied challenges, separate studies related to a complete micro-level scrutiny to evaluate viability must be done for each, before taking up execution. An efficient waterways system would require drawing up a healthy coordinated approach on harmonising line flanked by the national system and other waterways. The said plan should closely glance into the several undercurrents, comprising competing requirements, feasible domestic resistance and also work intimately and in harmonisation with respective state governments. This will enable fast and successful execution of this significant national venture.

INTEXT QUESTIONS 7.7

1. _____ building is extremely capital intensive.
2. Collaborating with _____ has the main role to play in the growth of inland waterways division
3. The building of jetties and river ports will lead to removal of _____ forests in the location.
4. There is a severe stortege of Maintenance, Repair and Overhaul) amenities for _____ ships.

WHAT YOU HAVE LEARNT

- Transport is the movement of people, cargoes, and related goods from one location to another. Methods of transport include air, rail, surface, ocean, cable, pipeline as well as space. Transport management is important because it enables business among people and industries, which in turn create civilizations.

- A waterway is a navigable of water and an essential part of human activity. The reason is the during the times of prehistoric times and navigability it has permitted watercraft and canals to pass through every body of water. Europe is a continent with a huge variety of waterway characteristics, which makes this category valuable to respect the different classes in waterway.
- An inland waterway is a system in the form of rivers, canals, backwaters and creeks that can be used for transportation in place of or in addition to roads and rails. Through the ages, rivers have served as adequate waterways, carrying people and goods over long distances.
- India is gifted with several Inland Water Transport (IWT) alternatives that consist of rivers, canals, backwaters, creeks, and tidal inlets. India's share of cargo moved on inland waterways has the ability to enhance when compared to other modes. It is significant to boost the share of the nation's inland waterways as they are extremely reasonable and an eco-friendly form of transport.
- The major peninsular river structures comprising 1. The Narmada 2. The Tapi 3. The Godavari 4. The Krishna, and 5. The Mahanadi rivers.
- Issues and Challenges of Inland waterways are 1. Estimation charges 2. Insufficient depth 3. Force on other activities 4. Insufficient air draft 5. Lack of night navigation 6. Lack of IWT ships 7. Scarcity of MRO amenities 8. Insufficient industries 9. Insufficient funds and 10. Ecological impact.

KEY TERMS

Transportation	Waterway	Goods
River	Glacier	Navigable
Sea	Peninsular	Polar ice
Stream	Lake	Ponds

TERMINAL EXERCISE

1. Sketch the different types of Inland waterways
2. Discuss the development of National Waterways

3. Highlight the navigable structures of inland waterways
4. Write a note on the Tapi river system
5. Bring out the social impact of inland waterways
6. List out the merits of inland waterways
7. Highlight the scope of inland waterways
8. Bring out the sources of inland waterways
9. Explain the Peninsular Rivers in detail
10. Spotlight the issues and challenges of inland waterways

ANSWER TO INTEXT QUESTIONS

7.1

1. Transportation
2. Waterway
3. Space
4. 14500

7.2

1. Rivers
2. 2016
3. Rivers
4. Creeks.

7.3

1. Three
2. Assam
3. Indus
4. Canals

7.4

1. Employment
2. North America
3. Locks
4. Navigation

7.5

1. 1986
2. Million tons per annum
3. Ferry
4. Taxes

7.6

1. Ganga
2. Kailash
3. Shallow
4. Eastern

7.7

1. Ship
2. Public-private joint venture
3. Trees/ mangrove
4. IWT

DO AND LEARN

Learners can undertake their activity work in the areas of inland transportation / warehouse /distribution organisations .