5.3.3 Chandel Water Supply Scheme

(1) System Development Plan

a. Expansion of Treatment Plant

Figure 53.11 shows the relationship between the daily maximum water demand and the existing treatment capacity for the Chandel WSS. Given the existing treatment plant capacity is 15,000 m^3/day, there is no immediate need to augment the WSS.

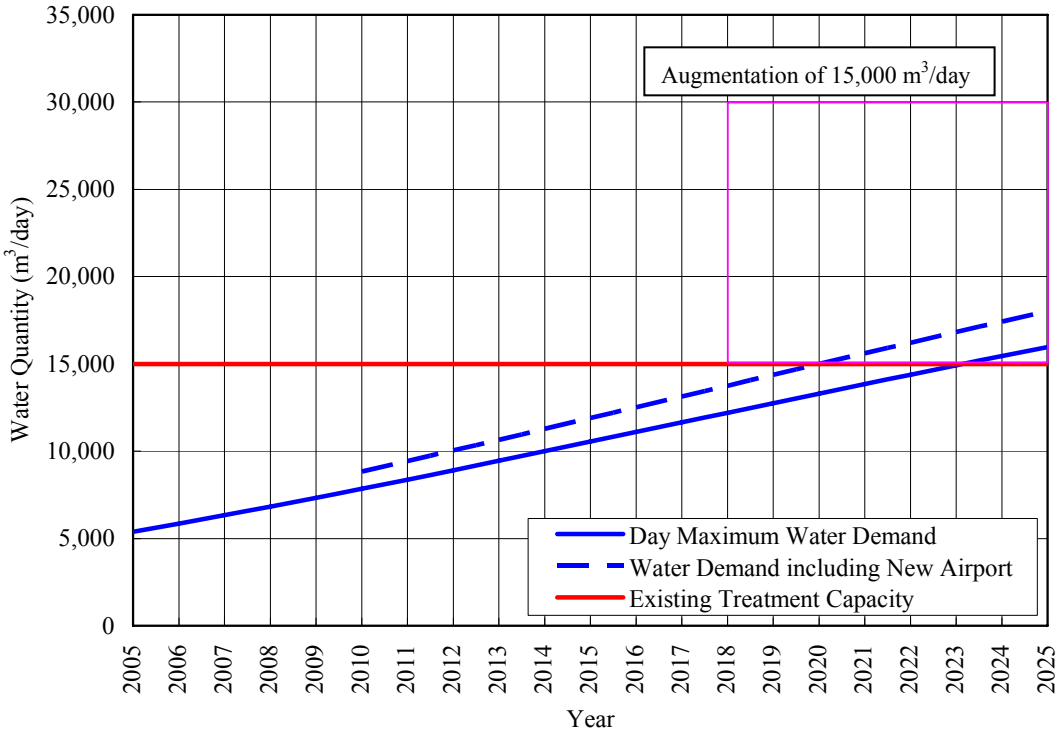


Figure 53.11 Development Plan for the Chandel WSS

The government of Goa proposes to construct a new airport in Mopa. If the new airport is constructed, the expected daily maximum water demand is represented by the dashed line in Figure 53.11. According to Goa's Department of Transportation, the new airport will be operational in 2010. The necessary water demand for the new airport and its associated facilities in 2010 is estimated to be 1,000 m^3/day by the Department of Transportation. In this case, the augmentation of the existing plant by 15,000 m^3/day will be necessary. However, it is recommended that before implementing the augmentation, the demand projection be reviewed based on current conditions and the necessary expansion capacity be re-evaluated.

b. Transmission Plan

As mentioned in section 5.2, the Chandel WSS covers only the Pernem and Pernen Talukas. Figure 53.12 shows the transmission plan for the Chandel WSS in 2025.

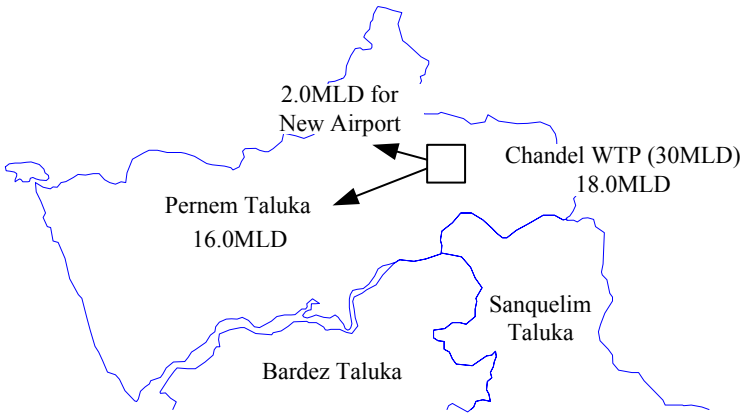


Figure 53.12 Transmission Plan for the Chandel WSS

(2) Treatment Plant

a. Water treatment Plant Capacity

A new water treatment plant of 15 MLD capacity is proposed in the Master Plan. According to the Water Resources Department, the water resource availability for the Chandel WTP is 110 MLD from the Tillari Canal.

b. Proposed Water Treatment Process

The proposed treatment process for the new water treatment plant consists of contact aeration, a coagulation basin, flocculation/sedimentation, sand filtration and chlorination. This process was designed considering the raw water quality and the existing process conditions (See Figure 53.13).

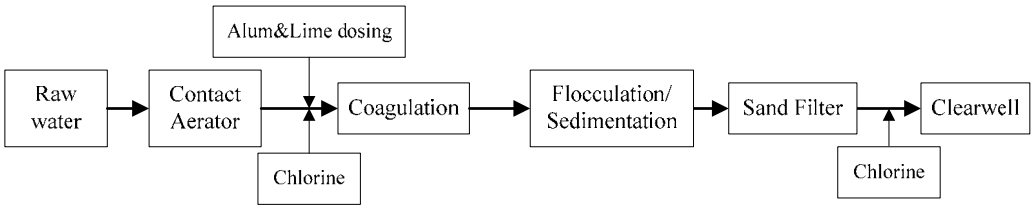


Figure 53.13 Proposed Water Treatment Process at the Chandel WTP

c. Implementation Schedule

The timeline for the implementation schedule of WTP is shown in Table 53.14. Rehabilitation

and improvement of the existing water treatment plant will be conducted during Stage I. Installation of chlorine safety equipment, replacement of equipment that has exceeded its design life, and installation of a generator and flow meters will be conducted over this period. Other replacements will be undertaken as equipment exceeds its design life. Transmission facilities for the new airport (located at Mopa) will be constructed during Stage I. A 15 MLD capacity plant will be constructed during Stage II.

Table 53.14 Implementation Schedule for Chandel WTP

Stage		Existing Plants	New Plants
Stage I	Components	- Installation of safety equipment - Replacement of raw water pumps and backwash pumps - Installation of generator and flow meters	Construction of transmission facilities for new airport
Stage II	Components	- Replacement of equipment as it exceeds its design life - Modification of coagulation process	Expansion of 15 MLD plant

(3) Transmission System

a. Proposed Transmission System

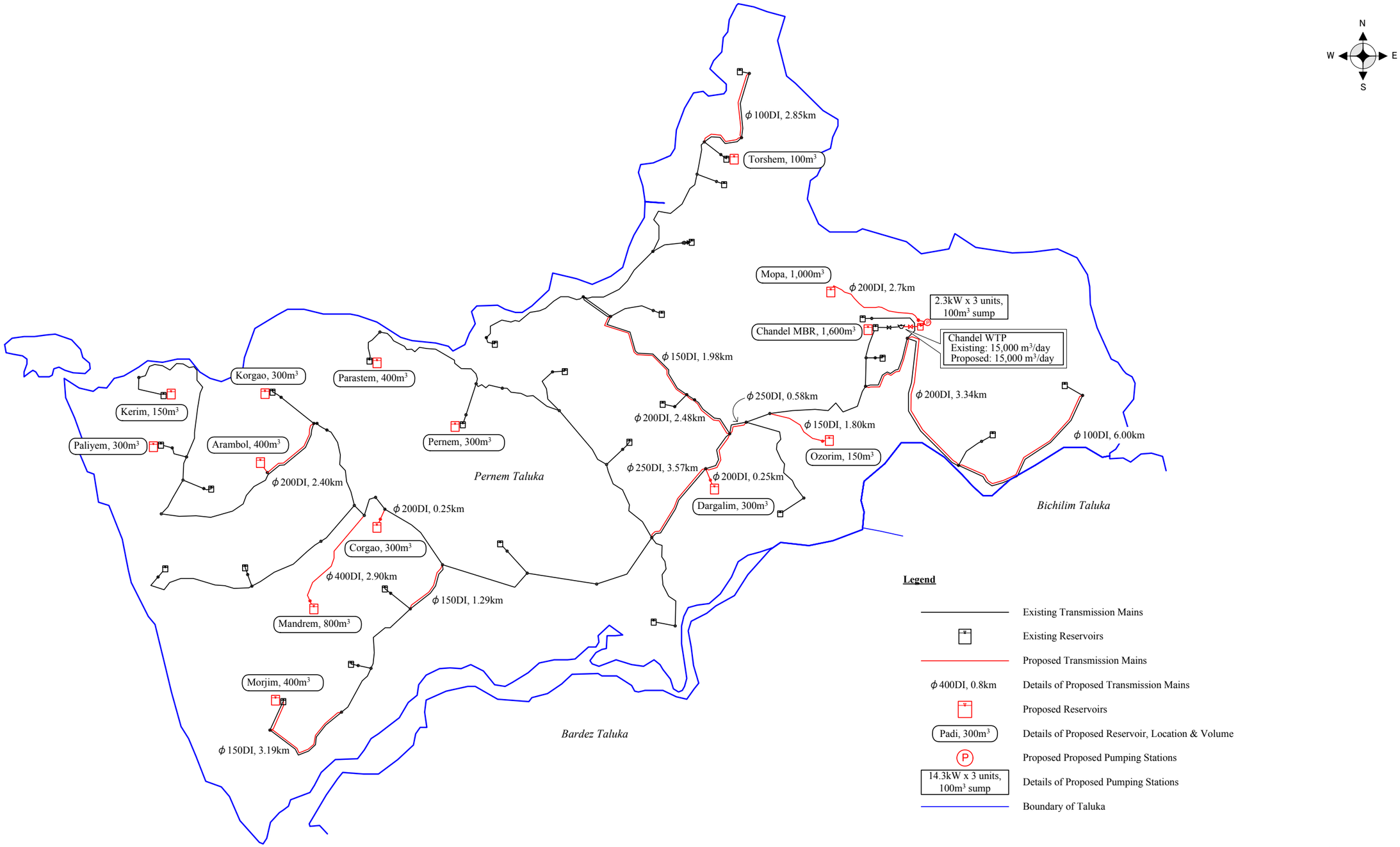
The transmission system shown in Figure 53.14 and summarised in Table 53.15 is proposed to supply future service areas and to meet the expected demand increases. Calculation using WaterCAD are attached in Volume IV Appendix M53 Results of Hydraulic Analysis.

Table 53.15 Proposed Transmission Mains for the Chandel WSS

Material	Diameter (mm)	Length (km)
Ductile Iron	400	2.90
	250	4.15
	200	11.42
	150	8.26
	100	8.85
Total		35.58

b. Rehabilitation of the Existing Transmission System

The master plan does not specify the rehabilitation or replacement of the existing transmission mains because the existing transmission mains were installed in 2001 and are still adequate.



Not to scale

Figure 53.14 Proposed Transmission System for the Chandel WSS in 2025

(4) Reservoirs

a. Proposed Reservoirs

To supply treated water to an expanded service area, the construction of 14 reservoirs (as listed in Table 53.16) is proposed. Locations and volumes of the proposed reservoirs are shown in Figure 53.14. The reservoirs have been specified in accordance with the PWD's plan.

Table 53.16 List of Reservoirs Proposed for the Chandel WSS

Location	Capacity (m^3)	Remarks
Chandel MBR	1,600	addition to the existing reservoir of 1,600 m^3
Mopa (for new airport)	1,000	with P/S (3 pump units of 2.3 kW and 100 m^3 sump)
Ozorim	150	-
Torshem	100	addition to the existing reservoir of 50 m^3
Dargalim	300	-
Pernem	300	addition to the existing reservoir of 150 m^3
Parastem	400	addition to the existing reservoir of 100 m^3
Morjim	400	addition to the existing reservoir of 100 m^3
Corgao	300	-
Mandrem	800	-
Korgao	300	addition to the existing reservoir of 70 m^3
Arambol	400	-
Paliyem	300	addition to the existing reservoir of 70 m^3
Kerim	150	addition to the existing reservoir of 150 m^3

b. Rehabilitation of the Existing Reservoirs

The Chandel WSS has 33 reservoirs, as summarised in Table 53.17. A detailed list of the reservoirs is attached in Volume IV Appendix M31 Existing Water Supply System. Table 53.17 identifies the reservoirs that need to be rehabilitated.

Table 53.17 Number of Existing Reservoirs

Reservoir Volume (m^3)	Number of Reservoirs	
	Existing	to be rehabilitated
1,600	1	0
800	2	0
250 - 400	2	1
150	3	0
100	12	3
50 & 70	13	3
Total	33	7

(5) Pumping Station

The proposal includes the construction of one pumping station for the new airport. The pumping station will be located at the existing treatment plant. The pumping station will pump treated water to the proposed Mopa Reservoir (listed in Table 53.16).

(6) Distribution Pipeline and House Connections

a. Proposed Distribution Pipeline and House Connection

The proposed length of distribution pipelines was calculated by multiplying the number of house connections to be installed (which reflects the increase in population served) by the unit pipeline length per connection (which is 14.26m as mentioned in section 5.1.2). Table 53.18 shows the proposed number of house connections and length of distribution pipelines.

Table 53.18 Proposed Number of House Connections and Length of Distribution Pipelines in the Chandel WSS (incremental basis)

Year	2007	2008	2009	2010	2011	2012	2013
Distribution Pipeline (m)	3,245	3,277	3,307	3,330	3,426	3,461	3,481
Number of House Connection	228	230	232	233	240	243	244
Year	2014	2015	2016	2017	2018	2019	2020
Distribution Pipeline (m)	3,512	3,524	3,483	3,522	3,546	3,581	3,602
Number of House Connection	246	247	244	247	249	251	253
Year	2021	2022	2023	2024	2025	Total	
Distribution Pipeline (m)	3,631	3,660	3,692	3,716	3,742	66,740	
Number of House Connection	255	257	259	261	262	4,680	

b. Rehabilitation of the Existing Distribution Pipeline and House Connections

The design life of the distribution pipelines is assumed to be 50 years. The plan is to replace 2 % of the existing 329km of distribution pipelines every year. This means 38 % of the existing pipelines will be replaced between 2007 - 2025. As a result the existing 125km of distribution pipelines will be replaced with new pipelines during the 19 years from 2007 to 2025.

The design life of the water meters at the house connections is assumed to be 10 years. The plan is to replace all of the existing water meters (i.e. 12,517 meters) within 10 years. As a

result about 25,900 water meters will be replaced during the 19 years from 2007 - 2025.

(7) Summary of the Planning

The components of the Chandel WSS Master Plan are summarised in Table 53.19. Figure 53.15 depicts the proposed Chandel WSS in 2025.

Table 53.19 Components of the Chandel WSS Master Plan

Facility	Proposed	Rehabilitation/ Replacement
Treatment Plant	15,000 m^3/day	15,000 m^3/day
Transmission Main	35.58 km	-
Reservoir	14	7
Pumping Station	1	-
Distribution Pipeline	67 km	125 km
House Connection	4,680	25,900

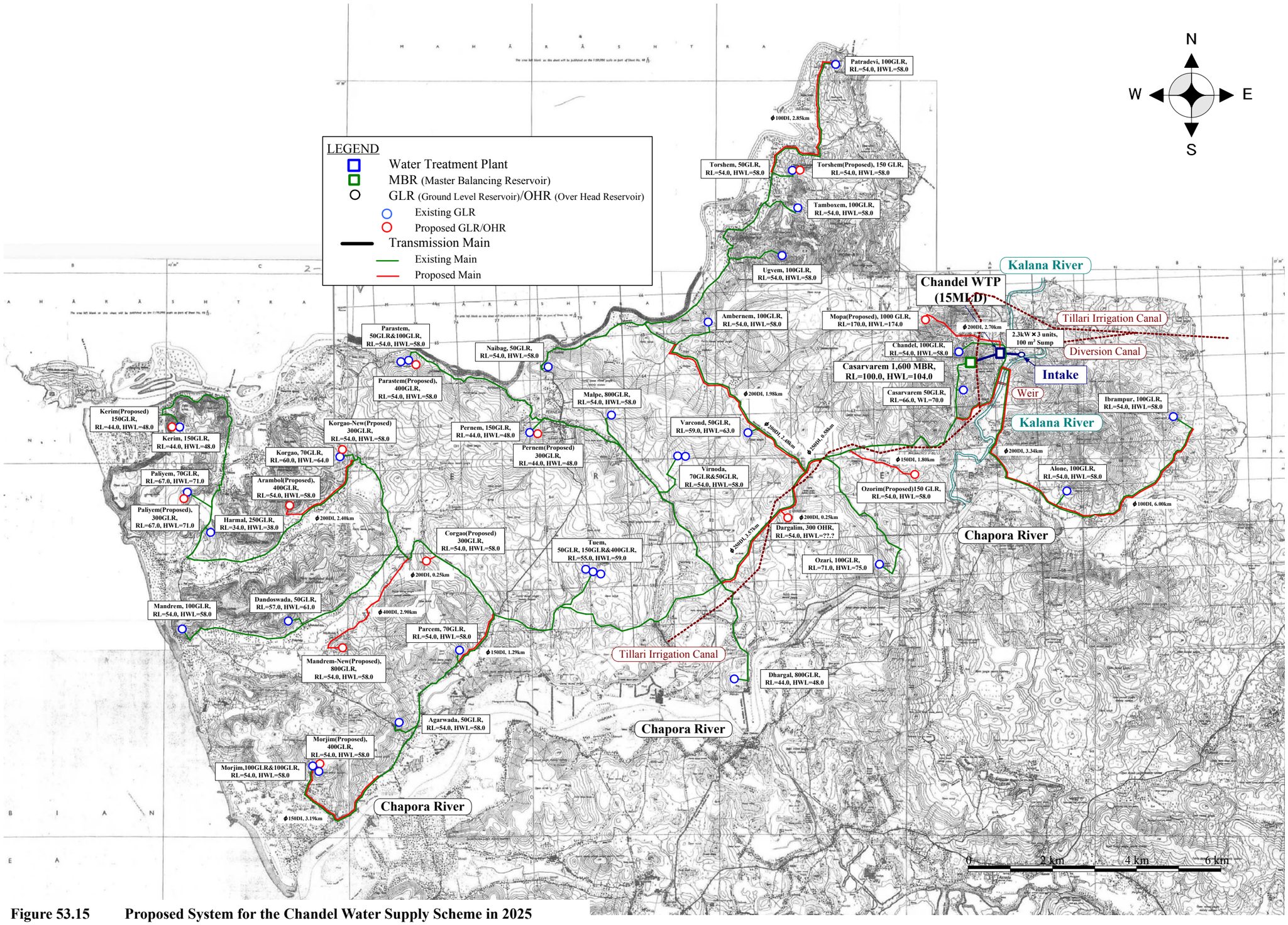


Figure 53.15 Proposed System for the Chandel Water Supply Scheme in 2025