

Aspects of Mussoorie's water supply, colonial and contemporary

Back in 1997, a Supreme Court study on the carrying capacity of Mussoorie highlighted the shortage of critical resources such as water and land¹. In the intervening years this shortage has increased, and in 2014 an ambitious 400-crore four-stage plan was proposed to pump water from Yamuna River. The preliminary survey for this project is set to begin in early 2015². Given its capacity, the mammoth pipeline may overshadow other measures also proposed in 2014, such as the protection of recharge areas for existing springs³. While the plan remains on paper, however, it is worth considering the sustainability of Mussoorie's existing resources, both to assess the need for a pipeline and the situation if it is built.

Nature of this report

This report sketches a number of topics in relation to the current water shortage in Mussoorie and its development. It discusses colonial Mussoorie, pointing out that infrastructural problems were present despite the lower population. It looks at the water supply of early colonial Mussoorie, including the Murray Springs pumping scheme, one of the most ambitious of its time. It examines the *Forest Working Plan 1905-35* for a trace of interest in water supply on the part of Mussoorie's colonial foresters. Thereafter it proceeds to contemporary Mussoorie, illustrating the *Carrying Capacity* data with a number of interviews conducted with Mussoorie residents. Finally it presents information about a private water-sharing arrangement concluded between Woodstock School and a nearby village, with a view to finding examples of sustainable schemes.

It doesn't exhaust these topics (with the exception of the *Forest Working Plan 1905-35*, which has been fully examined). The limitations were those of time and materials. In the case of Woodstock, it would be necessary to access documents which the school was reluctant to share. As for the colonial water supply, further information might be found in municipal documents and in J.P. Uttarakhandi's book *Mussoorie Dastavage*.

The *Forest Working Plan 1905-35* mentions that the Murray Springs block should be treated carefully as it contains important springs. But the link between forest cover and water is not elaborated. To find out what kind of theoretical connection was made in British times, it would be necessary to examine in detail the writings of colonial conservationists. The *Forest Working Plan* itself does not refer to theory.

1 *Carrying Capacity of Mussoorie*.

2 <http://www.tribuneindia.com/news/community/survey-for-water-project-begins-toda/37085.html>

3 <http://www.tribuneindia.com/2014/20140604/dun.htm#6>

I was unable to find the *Working Plan 1928-44* in FRI, Dehradun, though there is a catalogue reference. According to a summary in *Working Plan 61-76*, however, the 28-44 plan adds nothing of interest.

Notes on the interviews conducted with Mussoorie residents are appended to the report, as are photocopies of the two *Working Plans*, a page from the 1924 Guide to Mussoorie, and the *Doon Gazetteer's* description of the Murray pumping scheme.

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Population and Overcrowding

Perhaps the most striking change in Mussoorie, compared to colonial times or even the early 60s, is the great increase in population. In 2001, the winter population was 29,329 while the projected peak population was 72,694. By contrast, the permanent population in colonial times did not exceed 10,000 (1921). This number would more than double in the summer, as it does now; but the total numbers have increased by three to four times. This, of course, is a major reason why the resource base of the town has come under such strain.

Population: Mussoorie Urban Agglomeration

Pop'n	1880/1	1900/1	1911	1921	1931	1941	1951	1961	1971	1981	1990/1	2001
Perm.	4852 ⁴	6461	8052	9702	6116	7172	8550	11238	20389	18233	29629	29329
Max.	12110 ⁵	18400 ⁶										72694*

Except where noted, figures are from *Carrying Capacity of Mussoorie*.

*Estimate. *Carrying Capacity of Mussoorie*, p. 129

It would be easy to conclude that the smaller colonial town was a calm place, free from overcrowding and related problems. Indeed, the British were attracted to hill stations as health resorts, especially for ailing soldiers and young children. Atkinson's gazetteer of 1884 remarks that "the climate and health aspects of Mussooree are, as a whole, very favourable". (Atkinson vol.3 p.602) Only near the Himalayan Club were the houses "perhaps... too crowded for proper sanitation" (vol. 3 p.598).

However, examining in detail dr. McConaghey's report (Atkinson p. 603) we find that though malaria was rare, diarrhoea was common in Mussoorie and outbreaks of cholera had occurred several times. Dane Kennedy has argued that hill stations did not provide the hoped-for panacea for "tropical diseases" such as cholera, typhoid fever, hepatitis and dysentery (*The Magic Mountains*, p.26).

"Prior to the late nineteenth century," according to Kennedy, "doctors may not have fully understood the role that contaminated food and water" played in the spread of these diseases. Hence, as the hill stations' "growing populations... began to overwhelm their rudimentary water and sewage systems in the late 1800s, water-borne diseases spread" (*The Magic Mountains*, p.28).

4 *Himalayan Gazetteer*, census of Feb 1881, adding the figures for Landour and Mussoorie

5 *Ibid.*, census of Sep 1880.

6 *Doon Gazetteer*, census of Sep 1900, adding the figures for Landour and Mussoorie

Conditions were usually worst in the crowded bazaars, where most of the Indian population were located. In 1905, due to “anxieties over pollution and disease” the medical inspector recommended “removal of the main bazaar” in Mussoorie. (Kennedy p. 194) Instead, it was decided to cordon off the area, which could hardly have improved its sanitation.

Parts of colonial Mussoorie, then, were lacking in adequate infrastructure, and were therefore a source of contagion. While forced to admit the presence of disease in hill stations, the British sustained a belief in their overall benefits. Kennedy argues that this went beyond climate and involved notions of social and moral health, an effort to shield Europeans and sustain their separate identity. Yet the Europeans required a large population of service providers, whom they relegated to separate dwelling areas. This segregation started to crumble in the 1920s as Europeans began to leave the hill stations and educated Indians to move in.

Crowding, lack of infrastructure and its attendant hazards plagued colonial Mussoorie. Then, as now, they were related to disparities in wealth and status. Leisure in the hills is no longer exclusive to the Brits; Mussoorie is now in easy reach of millions of middle-class Indians with private cars. Their needs are catered to by the local residents – many of them descendants of those who catered to the British⁷. While less at risk of diseases like cholera, today's residents are still faced with problems of infrastructure. These are exacerbated by the water shortage.

Water supply

Colonial writers remarked upon the abundance and quality of Mussoorie's water supply. Early gravity sources were complemented by steam pumping from Khattapani to Landour Bazaar in 1882-3 (*Mussoorie Dastavage* p.122). Atkinson in 1884 described the water supply as “good in quality and quantity” and “exceptionally free from organic impurities⁸”, while a 1920s guidebook claimed that “filtering and boiling” of the Murray Springs water was “absolutely unnecessary” (*Major F. Cook's guide* – see appendix B).

As the health reputation of Mussoorie was partly misleading, we might wonder whether its water supply deserved the hype. Atkinson writes in 1884 that Mussoorie's drainage channels do not flow into streams used for drinking purposes, “with few exceptions” (p.599). Whom these exceptions affected is not stated. With the Murray waterworks in 1909, domestic connections were given a meter rate (Rs. 2 / 1000 l), while tapstands remained free. (*Doon Gazetteer*⁹) This may have

⁷ See R. Bond, G. Sali, *Mussoorie & Landour: Days of Wine and Roses*.

⁸ *Himalayan Gazetteer*

⁹ H.G. Walton, *The Gazetteer of Dehra Dun* (2011, Natraj Publishers). Reprinted in Miedema, *Mussoorie and Landour* (2014), p. 297-299.

differentiated those who could afford private water from those who could not.

Overall, though, it seems the British rose to the challenge of providing adequate water to the hill town. With growing population (25% increase between 1881 and 1901), an ambitious hydroelectric scheme to pump water from Murray Springs was begun in 1906 and finished in 1909. A power station was built below the confluence of two streams at Bhatta, supplying power to the town and across the hill to the pumping station below Old Brewery. The water was pumped up 1,700 feet to two reservoirs at Vincent Hill, the lift being “the highest in Asia and one of the highest in the world¹⁰”. The supply was further extended in 1913 and 1925 (Bhilaru). By this point, water supply was expected to reach “26 gallons per head of population which is probably the biggest allowance for any hill station¹¹”. (1920s guide).

In today's Mussoorie, that level of supply is elusive. The relative success of the British may be explained by the greater availability of resources, and the comparatively stronger position of the Municipal Board. Not that there were no conflicts. In the original hydroelectric scheme, the power source for the pumps was meant to be Kempty Falls. This, however, was in the lands of the Tehri Raja, who refused the British access. Accordingly they had to build the power station at Galogi, below Bhatta village. The availability of this alternative site, and financial support from Government, kept the scheme afloat at the cost of Rs 9,72,000 – more than a 40% overrun on the original estimate. (*Doon Gazetteer*)

A further question was ownership of the Murray Springs land. It can be gathered from colonial writers that previous to the water scheme, the land was privately owned¹². They do not mention, however, whether there were any difficulties in acquiring it for municipal use. In E. H. Ashworth's report on *Land Tenures of Mussoorie* (1904), three pages are devoted to the question, does the Municipal Committee have the right to streams found in private land? It is implied that this has a bearing on the anticipated waterworks.

Ashworth's difficulty was that, when Wells' Settlement of 1842 formalised the grants of land in Mussoorie, it did not explicitly reserve streams for public use. Wells expected that the newly formed Municipal Committee would do so in its bye-laws. The Committee, however, only reserved the right to build *roads* to streams. Ashworth argued that nevertheless, the word “grant” itself implied reservation of streams and minerals. Indeed, grants in the Doon Valley included this condition (*Doon Gazetteer*), and the general direction of colonial law was towards government control of surface water. Yet Ashworth felt that there was a need to clarify the rights of the Municipal Committee on this point.

¹⁰ As the *Doon Gazetteer* wrote, and many later writers repeated.

¹¹ 26 gallons = 118.196 litres. This would satisfy today's minimum recommendation of 120 lpd per person (see CC).

¹² F. Bodycot, *Guide to Mussoorie*, p.45.

Land rights in Mussoorie; ownership of Murray Springs

Ashworth's document on land tenures gives a very detailed account of the administrative development of Mussoorie. I will sketch this insofar as it pertains to Murray Springs.

In 1820, most of Garhwal (except Doon) was restored to Raja Soodarsan Shah, including parts of Mussoorie and Landour, which were nevertheless extensively built on by the British after 1823. This created friction which was addressed by Wells' settlement of 1842, wherein the Raja was asked to suspend his jurisdiction on these built-up lands, in exchange for 2/3 of the ground rent. Moreover, adjacent unoccupied lands could be auctioned off by the Municipal Board on the same conditions.

These included the relatively small portion which came to be known as Murray Springs. In 1845, General Wilkinson bypassed the Board and leased a chunk of unoccupied land directly from the Raja's vassal (the Mahant of Dehra). This land changed hands three times and ended up with Messrs. Mckinnon.

According to F. Bodycot's guide (1907), one part of the Mckinnons' land was sold to the Board for the "Bhilaru refuse shoot". Another portion "was purchased by Captain Murray and on this are the springs now to be utilized for the water-supply scheme, and which has now to be purchased by the Board for the purpose" (p.45) While no colonial writer mentions the actual sale, it must have taken place, since in 1910 we find that the Murray Springs area has become part of the municipal forest¹³.

It appears that even if the public right to streams was recognised, the Board had at least to offer remuneration. If there was any difficulty in these negotiations, it would only be apparent from the municipal files¹⁴. In any case, the Board was successful in acquiring the land and completing its scheme.

Such clashes as there were, as with the Raja over Kempt Falls (and earlier, with the village of Jharapani? See *Mussoorie Dastavage*), did not stop the Mussoorie water system from being extended. That there was less conflict than today may be explained by a lower density of inhabitation, and an accordingly larger number of (apparently) untapped water sources. Meanwhile, the solutions and laws developed for water management in colonial times continue to have an impact today. While the colonial government asserted its control of surface water, it left groundwater in private hands, and largely private it has remained¹⁵. This has implications even in

¹³ *Forest Working Plan for Mussoorie Municipal Forests, 1905-35*

¹⁴ For example, the Municipal Library has files on the Kandighat pumping station, which was being discussed as early as 1946. The Board wished to purchase a certain piece of private land, but the price asked by the owner was higher than what the Board proposed. The pumping station was not built until the 1960s.

¹⁵ M.C. Chaturvedi, *India's Waters: Environment, Economy and Development*, p.159-161

Mussoorie, where a large private school (and allegedly, some of the hotels¹⁶) have elected to provide their own supply from underground water.

Water and forest

To round off this brief account of colonial Mussoorie's water supply, I looked for references in the Forest Working Plans of the period.

The British developed an elaborate system of forest management. Economic aims were prevalent, from producing railway sleepers to providing for the local fuel and fodder wants of towns like Mussoorie. Imperial, economically oriented management of forests, in opposition to the claims of the peasantry, has been discussed extensively in R. Guha's *The Unquiet Woods*. That this conflict existed in the Doon may be seen from colonial sources of the time – a Mussoorie working plan complains about the peasantry cutting down “valuable”¹⁷ forest, while the *Doon Gazetteer* (p. 25) remarks that peasants would sometimes over-exploit forest because they feared its confiscation by the Forest Department. (The Mussoorie settlers, of course, were also guilty of deforestation¹⁸).

Conservancy, however, had an environmental dimension too. For example, colonial conservationists believed “that deforestation caused desiccation, a drying out of the land surface, resulting in a decline in rainfall, flash floods, soil degradation, and silting up of rivers¹⁹”.

A brief connection between forest management and water supply is made in *Working Plan for the Mussoorie Municipal Forests*, 1905-35, completed 1910. For the block acquired from Captain Murray, a special working circle was established since “owing to the fact that the Murray's Springs area contains the sources of the station water supply, it is necessary that fellings in that area should be restricted to the removal of dead, dying and overmature trees only²⁰”. Again, the “object... here is purely preventive. It is essential that the soil covering should be as little interfered with as possible.²¹”

Later, in 1933, the forest area adjoining Bhilaru pumping station was also declared reserved²². The British were aware, at least, that felling trees or disturbing the soil in the vicinity of the springs would affect the water supply. What exactly the link was, however, is not elaborated in the *Working Plan*, nor is there any further discussion of the catchment area.

16 See Conversation A.22 (G. Bharadwaj)

17 FWP 1905-35, p. 3

18 G. Sali, *Mussoorie across the Ages*.

19 http://www.eh-resources.org/colonial_forestry.html#_ednref9

Richard Grove, *Ecology, Climate and Empire. Colonialism and Global Environmental History* (Cambridge: The White Horse Press, 1997)

20 FWP 1905-35, p.6.

21 FWP 1905-35 p.7

22 FWP 1961-76, p.86. The reason is not specified.

Post-Independence Development of Mussoorie

While a lot has been written on colonial Mussoorie (mostly in a nostalgic vein), there is a gaping hole in the English literature when it comes to Mussoorie after 1947. No book that I have come across devotes more than a few pages to this subject. Accordingly, much of what follows (except where noted) draws on my discussions with informants, conducted in October and November 2014. These are appended to the report. A more detailed history, in Hindi, may be found in J.P. Uttarakhandi's book *Mussoorie Dastavage 1815-1995*.

Mussoorie's popularity with the British, which had been declining since the 20s, resurged briefly during the Second World War. With Independence and Partition, however, most of the British left, selling their houses cheaply or, in some cases, simply abandoning them²³. A number of Muslims also left at Partition (some to return later), and a few Muslim properties were torched (Miedema²⁴). Despite an influx of Hindus from Punjab, the hill resort of Mussoorie had lost its main clientele, and was "disconsolate" in the early 50s (A.R. Gill, *Valley of the Doon*).

The town's economy began to pick up slowly in the 60s. The founding of the Lal Bahadur Shastri Academy increased demand for goods and services. The arrival of the Tibetans boosted the town's population, which doubled from 1961 (11238) to 1971 (20389). Besides the new arrivals, there were the descendants of those Indians who worked as merchants, craftsmen, domestic servants etc. for the British. A few managed to obtain property cheaply²⁵; many retained their ancestral function²⁶ as a new set of visitors began to trickle in.

In the 60s, these included wealthy individuals from Bombay, Calcutta and elsewhere, who tended to rent a house for several months. The modern tourist trend began to pick up from the late 70s, and tourist numbers doubled between 1979 and 1988. The same period witnessed the intensification of limestone mining, which had begun in the 1960s. It was perhaps the most overt ecological threat to post-Independence Mussoorie, bringing deforestation and a dramatic drop in water tables of the area, and on occasion burying entire villages in debris (P.K. Thadani, *Chronicles of the Doon Valley*). Quarrying sparked a protest movement which culminated in a wholesale ban by the Supreme Court.

While this highly visible threat to Mussoorie was averted, the gradual pressure on the town's resources by tourism and the hotel industry has continued to build. As ownership of private cars

²³ Appendix A, conversation A.27 (Sunil)

²⁴ Miedema p.283.

²⁵ Appendix A, conversation A.27 (Sunil)

²⁶ *Wine and Roses*.

increased, many more middle-class Indians from Delhi and the region acquired easy access to Mussoorie, for the weekend or just for the day. In 1992, annual tourist numbers reached 17.6 lakh, and then declined slightly in the following years. Unabated construction between 1990-97 prompted another Supreme Court ban, which however has proved less effective. While Mussoorie has been resurrected as a hill resort, the pressure of modern industries and the population boom are straining its image as an idyllic escape from the heat and bustle of the plains.

Mussoorie: Annual Tourist Numbers 1979-1996²⁷ (in lakhs)

Year	1979	1983	1984	1985	1986	1987	1988	1990	1991	1992	1993	1994	1995	1996
Tourist	6.2	8.3	8.7	9.5	10.5	11.4	12.3	13.7	15	17.6	14.7	12.2	12.8	14.1

Mussoorie Carrying Capacity: Water

By 2011, the off-season population of Mussoorie was 38,118 while the estimated in-season population was 80,963²⁸. Since colonial times, the water supply has been extended several times – in the 60s, 70s and 90s. This has not proved to be enough and presently, the in-season demand of water (14.4 MLD) is almost twice the supply (7.67 MLD)²⁹.

In order to illustrate the bare data, I spoke to a half a dozen³⁰ residents from different parts of Mussoorie on the subject of water supply. All perceived a decline in recent decades, which three informants dated from the 70s. Water supply had been 24/7, whereas now it was reported as 1/hour once a day (Landour Bazaar and Clock Tower) and 30-40 min twice a day (Camel's Back Road). Gaps in the supply occurred – one informant reported a three-day gap in November, while another spoke of a gap of 1 or 2 weeks, four summers ago, which had forced the government to send up tankers.

There were also complaints about the quality of water. The Clock Tower informant (Appendix A.23) said that filtering had been necessary since 1991, and explained this by a change in the area's source of supply. The Landour Bazaar informant (A.24) complained about getting black water from his tap one occasion, while an informant at Sister's Bazaar, Landour, had found tiny black organisms in his bathwater. In the *Carrying Capacity* report, 81% of 303 people surveyed found water quality to be inadequate. Yet the report states that “it is not... clear as to why” this was

²⁷ Data 1979-88 is from *Hill Resorts of U.P. Himalayas*. Data 1990-96 is from *Carrying Capacity*, p.127.

²⁸ Base document

²⁹ Base document again. However, an alternative supply figure for 9.18 MLD is also given there – is this for off-season?

³⁰ Appendix A, conversations A.21-5, A.28-9

the case³¹. Clearly there is room for a more detailed questionnaire about perceptions.

To address the water issue, a stakeholders' meeting was called June 2014 in Mussoorie, which resulted in several suggestions, including the mapping and protection of spring recharge areas, the upgrading of pumps and – more dramatically – a 200-crore project for a pipeline to Yamuna river. To assess the need for this ambitious proposal, one must examine the viability of current arrangements for water distribution, particularly in times of shortfall.

Arrangements by private institutions

The municipal supply is not sufficient to cope with the peak population load in summer. Accordingly, private institutions such as hotels have begun to make their own arrangements for supply and storage. One hotelier (A.25) reported that at full storage capacity he will last 3 days with all 70 rooms in the hotel occupied. Tankers of 10,000 l capacity ferry water to this hotel, at a rate of Rs 13,000. The hotelier claimed that due to a ban on daytime ferrying, the tankers drive by night only³². This, however, was contradicted by other informants³³ who have seen tankers going to and from Mussoorie Lake 24/7. The hotelier questioned said that his hotel was not using this water for drinking purposes (which is as well since it isn't potable).

It was also alleged by several informants that the water authority is diverting domestic supply to hotels³⁴. This allegation was discussed with respect to Jaypee Hotel in a 2010 Tribune article by Hugh Gantzer³⁵, then chairman of the SCMC sub-committee. The article's main subject was the expansion of Jaypee Residency by 42 rooms, which was sanctioned by the Ministry of Environment and Forest against the recommendations of the Monitoring Committee. As violations of the 1996 moratorium on construction have occurred without any such sanction³⁶, it appears that the economic incentive to further tourist development is still very strong. If, at the same time, arrangements by private institutions are not beneficial to local communities, the situation becomes increasingly untenable.

In order to explore this point, it is worth asking whether any positive examples of such arrangements exist. The Municipal Board itself has pursued a number of negotiated settlements in recent decades – some of which failed (Aglad) and some succeeded (Dhobighat). Among private

31 *Carrying Capacity*, p. 25

32 Appendix A, conversation A.25

33 Such as Appendix A, conversation A.22 (G. Bharadwaj)

34 Appendix A, conversations A.21-2

35 <http://www.tribuneindia.com/2010/20100517/dplus.htm#1> The “reality was that the Jal Sansthan had diverted the supply of drinking water, which was meant for the residents of Barlowganj and Jharipani, to the hotel”

36 Conversation 29 Oct.

institutions, next to the hotels, the schools play an important role. According to the *Carrying Capacity* estimate for 1997, there were 6,028 boarders in all Mussoorie schools, amounting to 14.7% of the in-season permanent population (40,892)³⁷. One of the largest public schools in Mussoorie has established a private water arrangement, which it shares with a village downstream. This might provide another instance for examining the equity and sustainability of private water arrangements in Mussoorie.

Case study: water settlement between a Mussoorie school and a village

[See Appendix A.1 – *Woodstock Conversations*]

Note: Except for the first paragraph, the information presented here is based on my discussions with Mr. J, head of maintenance at Woodstock School. Mr. J requested **anonymity** for himself and for the school in the event of this information being published. He did not wish to give details of the agreement signed between Woodstock and Chamasari village for the use of the Midlands Stream.

I spoke also to a senior officer at the school, however, his data contradicted that of Mr. J (see footnote). As the senior officer disclaimed expertise in water affairs, I am not relying on his statements here, except where the rainwater project is concerned.

The school is one of the oldest in Mussoorie, with the original estate obtained in the second half of the 19th century. It currently has about 1000 members in all (500 students and 500 staff), which is significant in comparison to the town's permanent population (30,118 in off-season according to 2011 census³⁸). The school has a winter break and a summer break, which in 2014/15 lasts from 6 June to 30 July. Given that the peak tourist season is May to July, the school is open during 37 days of the peak season, when municipal water supply is under most pressure.

The school's increasing demand for water, combined with municipal shortages, led it to obtain a private water supply in 2000. Students' expectations had increased – they would “make a face” if asked to take bucket baths – and a pressurised water system was introduced in 2003. The school continues to draw about 20% of its water from the municipal supply. The other 80%³⁹ is now provided by an underground stream within the school's territory.

³⁷ CC p. 38

³⁸ This off-season figure may not include boarders in Mussoorie's schools. Compare the figures given on p. 38, *Carrying Capacity*.

³⁹ The senior officer of the school reversed this figure, claiming that 20-30% is derived from the stream and 70-80% from the town. He appeared to be unaware that a formal agreement had been signed with the village, which he identified as Dhobighat. I am discounting these statements since he was reluctant to share information, and claimed not to be an expert on the water scheme.

The school has signed a written agreement to share this water with a village downstream. It is not clear why, given that underground water on private land is not strongly regulated. I was not told what the duties are on the part of the village, or what the duration of the agreement is. Without further information, it is hard to say whether this agreement on the part of the school is motivated by ethical concern or some other reason.

Assuming that the school was free to dispose with the stream as it chose, the existence of a formal sharing agreement would at least give it some obligations towards the village. Of course, the school would have had the stronger negotiating position with respect to the terms of the agreement. But it is not clear what particularly valuable duties the village could perform for the school. Situated downstream, the village does not have power to influence the stream.

The question may be one of reputation. One of the school's avowed aims for 2020 is to develop its level of community engagement. The school's image could suffer if it harmed a village's water supply - *and* if this made the news. Water-related protests by villagers are not unknown in the area. In 1984, a municipal pumping scheme from Aglad was abandoned “partly because of opposition from farmers” (*Carrying Capacity* p.89). On May 25, 2014, villagers from Chaijula Patti used their upstream position to bargain for road connections⁴⁰.

The Chamasari villagers, however, lack the upstream advantage.

The fairness of the scheme can only be confirmed by further information, which the school's officials did not give me. The other question is the sustainability of the scheme. Should the school's demand grow significantly, it would have to either increase its dependence on municipal water or draw more from the stream, setting its sustainability in question. At present, the school is growing at a slow pace (student body has increased 6.95% between 2006 and 2013). If growth remains slow, and the school implements its proposed project of using rainwater for washrooms, then perhaps the scheme has some perspective.

This will depend also on the condition of the stream. According to the school's representative, the recharge area of the stream has not been examined so far.

Growth of student body 2006-2013 (according to annual info profiles)

2012-13: 508 students

2011-12: 515 students

2010-11: 524 students

2009-10: 468 students

2008-9: 479 students

2006-7: 475 students

40 <http://www.tribuneindia.com/2014/20140526/dun.htm#24>

Sustainability prospects

On the basis of limited data available on the school, it is at least possible that its water arrangement can be sustained for some time, without undue harm to the downstream community. On the figure of 80% water independence, the school will also be less of a drain on the municipal supply. In which case it is doing better than many hotels. While there are hotels which have introduced rainwater schemes (La Villa Bethany) or solar heating for water (Brentwood), on the whole such measures will probably not be sufficient if development continues apace.

It is the tourist industry, the mainstay of the town's economy, which has shown the greatest potential for unchecked growth and therefore, the greatest threat to the sustainability of the current water supply system. Were it possible to slow down this development or divert it to other nearby locations, then measures like the upgrading of pumps and storage capacity and the protection of recharge zones might be sufficient. (Issues of distribution would also have to be examined closely.) If development continues at a fast pace, however, the rationale for a major pipeline becomes ever more compelling.

In 2014, the scheme for a pipeline to Yamuna river was cleared by the state government. The estimated cost of this four-stage, 26 km pumping scheme is Rs 400 crore⁴¹. At this early stage of the process, however, uncertainties remain – the scheme may be challenged by interest groups in affected areas (far smaller schemes in the past, eg Aglad and Hardy Falls, have foundered in this way). Supposing that obstacles can be overcome, such a large scheme will doubtless take a number of years to complete, during which time Mussoorie will remain dependent on existing springs. Moreover, while residents would welcome a stable water supply, there are concerns about the future price of Yamuna water⁴².

Should the scheme succeed, it is projected to supply between 12.80 MLD in 2014 to 19.28 MLD water in 2044. Supposing that the current supply from springs, 9.18 MLD⁴³, can be sustained until 2044, it would still account for almost 1/3 of the total supply. The springs would therefore remain a valuable component of the town's supply and a fallback in case the pipeline does not deliver to expectations. Hence the rationale for catchment protection would not necessarily be removed by the success of the pipeline, though it would probably attract less attention.

Despite its grandeur, it would be a mistake to see the pipeline as a *deus ex machina* solution to the problem of Mussoorie carrying capacity. It has the potential to stave off water shortage for some time, but if development continues and scarcity in the region increases, the issue will

41 <http://www.tribuneindia.com/news/community/survey-for-water-project-begins-toda/37085.html>

42 Ibid.

43 Taking the higher of the two figures given in Base document.

eventually recur. For the near future, however, the pipeline would mean that some other parameter besides water becomes the limiting factor for the growth of Mussoorie.

Concluding remarks

Of the different parameters discussed in the Supreme Court-commissioned study on the carrying capacity of Mussoorie, this report has focused on water. The Supreme Court study, however, takes a broad approach, examining issues of land shortage, waste management, parking space, accommodation, power supply, availability of hotel beds, condition of roads and so forth. Among these, the dominant factor is the availability of land, as it impacts all of the others. Besides water, land is the critical limiting factor for the development of the town, and it is in short supply.

The extent of reserved forest in the town, and the S.C. ban on construction, are intended to conserve the ecology of the area and prevent unplanned development. However, in the context of acute land shortage, the drawback of a blanket ban is that it may prevent small-scale construction by the locals for their own needs⁴⁴, while moneyed interests obtain unexplained concessions (see the Jaypee article⁴⁵). This has the possible implication that local residents will resort to increasingly unsafe construction on steep slopes, while hotel development continues. The kind of regulation needed, and its enforcement, requires careful attention, particularly when key powers over water supply and construction permits have been taken away from the representative Municipal Board and invested in state-wide bodies (Jal Sansthan and MDDA respectively).

The more land is built up, the greater the infrastructure problems of the town will become. Therefore, even if the water supply is extended, the carrying capacity of the town will remain finite. Of course, one could lean on technology again, and circumvent the shortage of land, filling Mussoorie with tower blocks. That, however, would raise the question, which is going to give first – the basic services or the tourist appeal of the city? To the local residents, largely dependent on tourism for their income, both options are disastrous.

While the tourists and big hotel chains could simply go elsewhere, the ultimate losers would be the local residents. The tourist industry has not proven to be particularly self-regulating, while official attempts at regulation have not achieved the desired result either. The economic growth and population boom of recent decades has placed unprecedented pressure on Mussoorie, exposing the structural weaknesses of the former British hill station. The town which was geared to the needs of the British is now geared to the needs of tourists and the hotel industry, while the mechanisms of

⁴⁴ *Carrying Capacity*.

⁴⁵ <http://www.tribuneindia.com/2014/20141006/ukd.htm#1>

growth are beyond the control of the residents.

While Mussoorie's carrying capacity, in terms of water and land, may be elastic, it cannot be infinitely extended. Overdevelopment will carry a price.

(Photos on next page)



Shortage of land in Mussoorie: building on extreme slope. In 1997, over “ 50 per cent of the built-up area” was found “in land with more than 50 degree slope”. (*Carrying Capacity* p. 69)



Waste management? Mussoorie hillside

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APPENDIX A - CONVERSATIONS

A.1 WOODSTOCK CONVERSATIONS

A.11

Mr J, Head of Maintenance, Woodstock

1.30 pm, Wed 5 Nov, 2014

Woodstock School, Mussoorie

(Mr J has been a resident of Mussoorie for 8 years. Two old hands were also present during part of the conversation; Mr J checked some dates etc. with them.)

J: Since 1999/2000, the school has its own water supply.

Before then, they would get water from Jal Sansthan and tankers (for the lower school).

The reason to acquire their own water supply was the school's increasing need for water.

Since 2003 the school has a pressurised water system. Introduced showers etc: nobody wants a bucket bath these days, they will "make a face".

Q: How much has your demand increased? Has it doubled?

J: At least doubled.

Q: Besides increasing demand, were you also being affected by water shortage in the summers?

J: Yes.

J: We still have a few connections from the town supply. These are reliable.

Q: Which stream provides your water?

J: The Midlands Stream (an underground stream). We share the water with a village.

Q: Which village?

J: Kathwallah. (? Khetwala?)

Q: Have you had any conflicts over water?

J: There were some, but these "were sorted out long ago". Now we share water amicably.

Q: Is the stream on Woodstock land - did you have to apply to the Municipal Board?

J: It's on Woodstock land.

J: The town supply to Woodstock was (and is) from the six tanks above Char Dukan. (These get water from Khulti.)

Town supply is divided into two parts. The other reservoir is somewhere around Gunhill or Camel's Back Road...

Lower areas get better supply, since it is a gravity system. There are shortages in Landour.

Q: Also at e.g. Kulri?

J: Yes. You can tell by the crowds at the tapstands (in summer).

Woodstock doesn't have much in the way of water records. We only have water bills from the Jal Sansthan.

Q: Would it be possible to look at those?

J: I would need some time to find them...

On the whole, you should talk to the Jal Sansthan.

A.12

Ramesh Devmani

Thu 20 Nov

Woodstock

Ramesh Devmani keeps me waiting and he doesn't seem particularly eager to talk to me. He asks me what the study is about and where will the information be used. I tell him about the study and say upfront that it may be used in an academic publication and also in stakeholder meetings in Mussoorie.

*While his position is senior to Mr. J's, he claims that he is more involved in engineering, and not specialised in water. Also he has been in Mussoorie a year or two only. His information contradicts that given by Mr. J on **a number of counts**.*

Q: You have your own water supply?

D: **Most of our supply is from city connections**. One dorm is supplied by Midlands Stream.

Q: Does the stream provide a significant part of your supply?

D: **About 20-30%**.

Q: This stream is shared with a village? Which one?

D: **Dhobighat**. It's just down there, in the valley. It's been there for a century. This is an old arrangement.

Q: Is there some kind of paper document for this agreement?

D: **No, I don't think so**.

Q: Do you mind if we (CEDAR) go down there to have a look?

D: Go ahead.

D: We also have a rainwater project - we are trying to supply water to washrooms in this way.

Q: Have you been looking at the recharge area for your stream?

D: No.

Q: Are you interested in this?

D: Yes... *[noncommittal]*

A.13

Mr. J (Woodstock maintenance dep't)

Thu 20 Nov

Phonecall

After speaking to Mr. Devmani, I called up Mr. J to double-check some of the things he told me.

Q: I was thinking back to our last conversation. I realised that I forgot some things that you told me. Could I just check if I remember them right?

J: Ok.

Q: You said your stream was shared with a village. What was the name of that village?

J: I don't know... I can find out for you. I will call you back tomorrow.

Actually, I have it here.

Q: You have some paper?

J: I have it written down. When I joined the department, I found out about all these things.

Here it is: Thamasari.

Q: Could you spell that for me?

J: T-H-A-M-A-S-A-R-I.

*(I'm not sure if he says T or C. There is a village south of Woodstock called **Chamasari**, so that must be it. It is near Khetwala village, which I think Mr J was referring to last time.)*

Q: Okay, I have one more question. You said some of your water comes from the **town supply**?

J: Yes.

Q: A significant amount? About half?

J: I would say 20%.

Q: Are there some papers about these arrangements?

J: **We have a written agreement with the village.**

Q: Would it be possible to see that agreement at some point in the future? Or is it confidential?

J: It might be confidential. I have to check with my legal department.

A.2 OTHER MUSSOORIE CONVERSATIONS (in chronological order)

A.21

G. Saili

10 October

G: There's a water issue but

"There's not going to be a water famine - no chance of that!"

Q: Do you think the pipeline will happen?

G: Yes.

It is understandable why tourists are attracted to Mussoorie. And the town's economy depends on them.

The Jal Sansthan is diverting water supply to hotels. This is official policy.

A.22

Gopal Bharadwaj and his wife, ___ Bharadwaj

3 pm, Wed 29 Oct, 2014

Camel's Back Road, Mussoorie

[Q: Me

GB: Gopal

W: Gopal's wife]

GB: When I was 10-15 yrs old, we had water 24/7. Now, we get it for **30-40 minutes, twice a day**, through half-inch diameter pipes. (Overhead tanks fill up so normally they don't lack water, but this is because they are only 2 people in the house: with more people it would be difficult.)

GB: Supply varies between wards. Landour only gets water once a day.

GB: In the summer, hotels have tankers draw water from Mussoorie artificial lake. [Dhobi ghat?] **Tankers are queueing the whole day.** This water isn't potable.

40 yrs ago, the tourist profile was different. People came from Bombay, Calcutta, ... and rented private houses for 2-3 months. Several industrialists have houses near GB.

GB: Big hotels have the technology to tap groundwater. (This affects general water supply?) E.g. Maxotel at Kemptoy Road, Jaypee at Barlowganj, and Savoy (?) (Savoy is old - British system for the supply of hotels?)

W: The Brits planned Mussoorie around 7 flat areas. Since then, unplanned dev't.

There is now much less rain than before, also less snow - this affects springs.

Many springs have dried up.

GB: There were hundred springs, now only twenty. (Exaggerating?)

GB: Hoteliers are bribing the water officials to supply them water at midnight, when nobody notices. They need to cater to tourists who say, I am paying Rs 10,000 per night for my room, where is my water?

GB: The Supreme Court banned further construction but this ban has been ignored. Compare the situation in Simla: overconstruction has made buildings unstable.

W: "When I was a child, this was such a beautiful place." On the Mall side there were no houses.

W: "Commercialisation has destroyed these places." (Hill stations.)

GB shows me a document.

A booklet from around 1922, entitled "...Guide to Mussoorie..." (See appendix B)

*A table of annual rainfall 1912-1920s. **The maximum value is 170 inches/year.***

Water Works

Currently 2 pumping stations.

Main station: McKinnon. Draws water from Murray springs. Pumped up 1,700 ft to Vincents hill, where 3,00,000 gallons reservoir.

Water quality is generally excellent.

GB: Mussoorie had piped water before Delhi.

Q: Why has unplanned development taken off so dramatically?

GP: The municipal laws are being ignored, encroachments are made, officials are taking bribes.

In British times 1 acre was required for permission to build.

At one point the MDDA assumed authority over construction. Since then things have got worse: the MDDA is more corrupt (than the Municipal Board?). [C.f. the SCMC report.]

The S.C. ban on construction has not been heeded either. S.C. is too far away to monitor it. [However Ganesh Saili said that S.C. is updating its report?]

There were mango orchards by Rajpur Road in Dehradun...

W: Endless greed.

GP: Go and see Kemptoy Village. The slope there is now very fragile, last year a landslide buried some empty cars. Due to deforestation, Kemptoy Falls has less water nowadays.

A.23

_____ **Vinod (Surbhi's father) and Surbhi**

3.30pm, Fri 31 Oct, 2014

Heritage Center, Clock Tower, Mussoorie

Much of this discussion was in Hindi, I've recorded the English part.

[Q: Me, Dr. Chauhan, Som

V: Mr Vinod

S: Surbhi]

V: We have water one hour/day. I think it is the same in all wards. [*Mr Bharadwaj claimed otherwise.*]

V: Recently, we were 3 days without tanks being filled. This is rare for the current season. However, in summer it can be longer.

V: Until around 1972-75 the situation was better, we had water 24/7. Power cuts would be announced beforehand; sometimes they even visited your house and took your signature to show you knew about it.

V: Since then things have gone downhill. Water quality has declined: since 1991 we need a filter. Maybe because the supply comes from a different pipeline?

V: There were meters for domestic connections but, at least since 70s, they often didn't work.

V: The old method of applying for a water connection = you had to submit drawings.

V: At Bhilaru, there were carcasses... [*? Carcasses of what? I didn't get this bit.*]

Surbhi: The best example of rainwater use is La Villa Bethany in Landour.

V: The British were orderly and disciplined. After they left, discipline gradually vanished. It's the mentality these days...

A.24

Islam the tailor

3 pm, Wed 5 Nov, 2014

Landour Bazaar, Mussoorie

(Islam works at the shop of his elder brother Inam. I have visited Islam on several occasions. He likes speaking to foreigners and his English is fairly good, although he didn't finish school.)

(Last time I spoke to Islam, he said the water problem wasn't so bad. This time, though-)

Q: Do you have any problems with water?

I: Yes, we have a big water problem. For example, last night the water from the tap had a dirty/black colour. We boiled it.

Q: That stuff can make you sick?

I: Yes.

Q: How much water do you get?

I: Two hours... *(asks his wife)* no, one hour. 7:30 am to 8:30 am.

I: Four years ago, there was no water for 1-2 weeks. The government sent up trucks.

Q: Do you have a tank?

I: Yes, but a small one. We have no money to get a bigger one.

I asked Islam about his background. He was born in Mussoorie. His parents are from Saharanpur. His father came to Mussoorie in 1947, to work for British missionaries. At the time of Partition he left, returning in the early 50s.

Islam's family lived on the premises of a hotel, which was government property. In 1984 the property was sold as flats. Even now, though, Islam doesn't have the papers for his place - the neighbourhood housing society keeps them.

Q: If you could, would you move out of Mussoorie?

I: Yes, because there isn't enough business here. However, we don't have the money to move.

A.25

_____ **Kapur, uncle of Rajesh Kapur**

11 am, Fri 31 Oct, 2014

Brentwood Hotel, the Mall, Mussoorie

[Q: Me, Dr. Chauhan, Som
K: Mr Kapur]

Mr Kapur emphasises that water is not being harnessed properly in Mussoorie. By contrast, he says that Brentwood Hotel was demolished and rebuilt in order to ensure proper water use.

Evidence? On the roof, there is a tank & solar heater.

Q: How many rooms do you have?

K: 70.

Q: What is your water capacity? How long will it last you in peak season?

K: We have big tanks. When full, they will last for 3 days.

Mr Kapur laments the way Mussoorie has changed.

K: This is "no longer Mussoorie, it is an apology for Mussoorie".

K: There is a big problem of encroachment. This prevents people adding small bits of storage because all the land around them is built up.

K: The larger estates are held by visitors, who spend perhaps a few days a year in Mussoorie. Therefore they are not interested in the town's sustainability.

K: We pay tankers to get us water. For a tanker of 10,000 l capacity, we pay 13,000 Rs. Tankers are only allowed to ferry at night.

[This contradicts what I have heard from others, incl. Mr. Gopal, who said tankers operate 24/7 at Mussoorie Lake.]

K: During 200 days of the year, our rooms are 5-10% full. The lean season is August to 15 December, and 10 January to end March.

K: Currently we have 3 groups staying.

Q: Where are most of your visitors from?

K: We don't keep statistics but: Delhi, Punjab, UP, UK, Bombay, Gujarat, Bengal (*in rough order?*)

Q: Why do you think Mussoorie has developed in this chaotic manner? Was there no planning, or has the planning been ignored?

K: "I don't think it has been wilfully ignored." But the planning is not coordinated between departments. E.g. the road will be dug up to lay sewage and dug up again later to lay something else.

A.26

Diler

9.00 am, Fri 7 Nov, 2014

Char Dukan, Landour, Mussoorie

Diler works as language tutor, tourist guide and agent for a Delhi landlady, finding tenants for one of her properties. He offers it to me.

D: 25 years ago, a lady (*the same one?*) bought some land in Mussoorie for Rs 20,000. It is now worth crores.

The land is 7 acres with 12,000 sq ft built-up.

D: Delhi and Bombay people who own properties in Mussoorie are often old, don't like the monsoon/cold in the hills and come up rarely.

These days, a good deal for a house in a busy area of Mussoorie is 30-40 lakhs. For an average shopkeeper etc. who makes Rs 20 - 30,000 a month, it is hardly possible to buy a house.

Wealthy outsiders who buy property in Mussoorie cause difficulty for locals - they fence their properties, blocking passage, and hire guards who ask you questions.

D: My family home is in Dehradun but I have spent 9 months a year in Mussoorie since I was a kid. I prefer it here, though it is getting insecure these days (with the big money people etc.)

A.27

Sunil, Seema's husband

7.45 pm, 6 Nov 2014

Devdar Woods, Landour, Mussoorie

Sunil works as a carpenter and painter (of walls). Currently he has a problem with his right hand which has prevented him from working for several months.

His wife, Seema, is caretaker and cook at Snow View Guest House. She also has at least one other job. Their children go to English-language schools. The entire family is Christian (including Sunil's sister's family, who live in their house).

Seema speaks some English, Sunil very little.

Sunil begins to tell me about Mussoorie history. My friend, an American whose parents are Tamil, acts as interpreter.

S: At the time of Independence, many people in Mussoorie simply occupied buildings which the Brits had abandoned.

For example, Mr P ('s father?) occupied Devdar Woods and the building which is now Mr P's store. He has no (authentic) papers for these properties.

Often, it was the former caretaker / keeper of grounds who occupied the building when the owner left.

Mr P is now fighting a case over the plot opposite his store, which he also claims. His opponent is a well-known Bollywood actor (who actually has papers for the property).

S: My house was built by the British in 182_

(It was a servants' quarters. At the time, properties had three parts - the house, the cottage (where the man could entertain his friends, away from family) and the servants' quarters.)

S: The British flattened the sides of the hills to build roads. They would build two roads around each hill. One was asphalted and meant largely for British use.

(When the British went on horseback they would take the other road.)

During the colonial period, Indians (except for cops) were only allowed on the roads at certain times of day. If they went at other times, they would be beaten up by the cops. The cannon at Gunhill ensured that everyone in town knew the time.

Also, if Indian girls went on the roads late at night, they would be raped.

[The Wikipedia article on Mussoorie claims that the Mall had a sign "Indians and Dogs Not Allowed", whereas the Miedemas' book argues that there is no photographic evidence for that.]

Q: Was the Mall off limits to Indians?

S: At certain times of day (like the other roads).

S: The original Lal Tibba is now the site of a TV tower. When the tower was built, Lal Tibba was moved to the current lookout point.

Q: Did your parents move to Mussoorie?

S: No, my great-grandparents moved here. I was born in Sisters' Bazaar. My parents moved into the present house (*on the hillside below Tabor Cottage*).

The house used to be a servants' quarters. My parents expanded it.

A.28

B.K. Joshi

11 November

Doon Library, Dehradun

In current times:

Aboveground streams on private land are public property, but the status of underground water is unclear. This is a current topic of debate.

Mussoorie post-Indep chronology

Around 47: influx of people (presumably Hindus) from Pakistan
Muslims leaving - their lands declared "enemy property" and handed to Gov't (or squatted in - more likely?)
Brits also leaving...

Early 60s: IAS academy moved to vacant premises of Charleville hotel. This helps boost economy (cf. A. R. Gill's suggestions...)

60s-70s: Economy of country starts to pick up. Private cars still rare.

80s-90s: **Private cars** (Maruti) become more available, this gives significant boost to tourism, esp. in 90s. Jaypee hotel built.

In Brit times, economy of Muss dep't on schools and tourist season (May-June and briefly in Oct). In winter many shops closed down.

Most Brit regulations continued more or less intact after Indep, but enforcement became problematic in later decades.

In early years after Indep, Municipal Board still had control of water & electricity and was fairly strict in enforcement.

Later water taken over by JS... construction by MDDA... these agencies are not accountable to the town population.

Centralisation because: municipal bodies lacked funding for improvement of water systems etc. They lacked power to raise new taxes & were dep't on Gov't for funding. When they complained, Gov't decided to hand over care of water etc. to state organisations - a "normal bureaucratic response".

Cultivated land was a key source of revenue to the British, so they tried to extend the area of cultivation

- they would sometimes give revenue-free grants of land in order to extend cultivation (how would that increase revenue? After a certain time land becomes taxable?)

Key book on British land tenures in India
by Baden-Powell (1920s-30s)

A.29

Jai Prakash Uttarakhandi

Fri 21 Nov

Dehradun

J.P. is a fan of the British: they should "rule us again". He perceives modern Indian politics as irredeemably corrupt - the country is run by big business - Indian companies and TNCs. I say, some Brits were also corrupt. He says, well, it's human nature.

Tourism picking up from (late) 70s
Economic growth 80s,
But especially 90s: 5-star hotels, bungalows, cottages, private cars

Problem of population crisis in India

(1991: liberalisation of economic policy, which J.P. perceives as negative.)

In 70s, water was still 24/7
Water was perceived by Indians as something that should be free... now it has a price tag

Q: The Jal Sansthan?
J.P. gestures - "give me money".

Q: Was Murray Springs on private land in British times?
A: It was private land, but the Brits purchased it.

APPENDIX B – Extracts from documents

** Forest Working Plan 1905-35*

** Forest Working Plan 1961-76*

** Guide to Mussoorie by Major F. Cook (1924)*

** Doon Gazetteer (reprinted in Mussoorie Across the Ages)*

settlement do not follow contour lines, but go across country from pillar to pillar, placed usually upon ridges, there is apt to be considerable trespass.

History, legal position and rights.

11. The following is a short sketch of the history of Mussooree subsequent to the conquest in 1814.

After the conquest of the Dun in 1814, which secured to the British the whole of the provinces heretofore forming the Raj of Garhwal, and after these, with the exception of the Dun, had been restored to the Raja Soodarsan Shah, it appears that the original boundary between British territory and the Garhwal state was the crest of the Mussooree range, the southern slope of the hill being British territory and the northern belonging to the Raja of Garhwal.

Before 1829 a number of Europeans had settled at Mussooree on land which was the property of the Raja. From this cause various disputes arose, which were settled by the payment to the Raja of an annual rental assessed by Col. Young, I.C.S. Up to the year 1842 the area of land thus occupied by buildings continued to increase, and in that year Mr. F. O. Wells was appointed a special Commissioner to draw up a settlement for Mussooree. Under this settlement, among other things, all land, not included in holdings, but available for building sites and not required by villagers, was included in the settlement, and the natural boundary between Tehri and Dehra was replaced by an artificial boundary demarcated by pillars. The Raja was asked to refrain from exercising jurisdiction over land thus included in the settlement, but was of course still entitled to a percentage of the rental. The present forest areas were by this means included in the Mussooree settlement area. These areas were open to grazing and for fuel and were intended for building sites and not for cultivation. However the Tehri villagers encroached on these lands, they cut down valuable forests for fuel for lime burning and broke up the land for potato cultivation, and the grazing became so heavy that reproduction was impossible, and hills, which were a few years before covered with fine trees, became bare and brown. Under the Tehri laws these villagers had no rights to cultivate these areas and were mere trespassers; consequently the Raja in an agreement made on the 17th October 1894 between the Raja of Tehri Garwal of the one part; the Municipal Board of Mussooree of the second part; and the Secretary of State in Council of the third part agreed, in return for certain payments, to hand over these cultivated areas, and in fact all the land within the Settlement boundary, to the Municipal Board, free of all rights and concessions, to withdraw all his subjects from these areas, and to provide them with culturable land elsewhere. The actual transfer of the land to the Municipal Board was made under an agreement dated the 28th of June 1902, (vide Appendix D).

Subsequent to the agreement of 1894 all cultivation of unoccupied or forest land within the Mussooree boundary was suspended and the forests closed to grazing. The chief areas to suffer from this grazing and cultivation were the Badraj, Banog, Tonatu and Koeti-Kimoin blocks.

12. From the preceding paragraphs, it will be seen that the forest areas at present in possession of the Municipal Board are free of all adverse rights or concessions, except perhaps the right of way.

13. Under G. O. No. 211/XIV—1904, dated the 27th April 1905, the Local Government conveyed sanction to the proposal that the Mussooree municipal and cantonment forests be managed by the Forest department under section 38 of the Forest Act (VII of 1878), and in consequence the divisional forest officer of the Dehra Dun division took over charge of these forests on the 2nd October of that year.

Composition and condition of the crop.

14. The municipal forests may be said to consist for the most part of a very thin young mixed forest in which the predominating species is the Ban oak (*Quercus incana*); the more numerous of the miscellaneous species being Burans

path to the market the wood is taken by pack ponies, which carry each on an average $2\frac{1}{2}$ maunds. The rate for pony transport is Re. 0-0-6 per maund per mile.

Grass is exported by head loads and pack loads. It has been customary hitherto to sell the grass in the municipal blocks by auction for a lump sum: the lessee then sells the grass on petty permits.

This lease should produce at least Rs. 950 per annum.

Net value of each class of produce.

30. The retail value of dry fuel in Mussooree, consisting of 2 parts of Oak to 1 part of Rhododendron or other inferior species, is Re. 1 for 2 maunds.

The wholesale price of dry fuel is Rs. 50 per 100 maunds of 82 lbs. each, for green fuel, Rs. 40 per 100 maunds of 82 lbs. each.

The retail price of charcoal is rising, at times it is as much as Rs. 2 per maund.

The rate of Chir scantlings, planks and beams in Mussooree is Rs. 1-4-0 per cubic foot, of Deodar Rs. 2-4-0, of Blue Pine (Kail) Rs. 1-8-0 per cubic foot. The net value of the above trees cannot be ascertained.

CHAPTER V.

MISCELLANEOUS FACTS.

The forest staff.

31. For many years four forest guards have been retained for the municipal forest areas. The services of the four forest guards will be retained, and their pay will range from Rs. 6 to Rs. 8. The forests constitute a range under a ranger of Rs. 50 per mensem.

The labour supply.

32. Out of season there should be no difficulty in obtaining sufficient labour for all requirements, but in the summer months, owing to the great demand for coolies and the high rate of pay given to them, it is difficult to obtain labour at a reasonable price.

PART II.

FUTURE MANAGEMENT DISCUSSED AND PRESCRIBED.

CHAPTER VI.

BASIS OF PROPOSALS.

Working circles how composed. Reasons for their formation.

33. The forest area consists of eight distinct blocks, but owing to the fact that the Murray's Springs area contains the sources of the station water supply, it is necessary that felling in that area should be restricted to the removal of dead, dying and overmature trees only. Hence this area has been made into a separate working circle, and called the Selection Working Circle. Its area is 85 acres. The remaining seven blocks, owing to their small total acreage, will form one working circle only termed the coppice working circle. Its area is 2,572.6 acres.

Blocks: justification of the sub-divisions adopted.

34. The forests are naturally subdivided into distinct and separate blocks (paragraph 9).

Analysis of the crop: method of valuation employed.

35. No enumerations have been made of the growing stock, nor is this necessary in view of the system of treatment proposed. A detailed description of the forest growth, block by block, is given in Appendix A.

36. As regards the rate of growth of the Ban oak no very accurate data are available. It is however agreed by neighbouring forest owners that this oak, from coppice, attains a girth, at breast height, of $2\frac{1}{2}$ feet in 30 years, and from 3 to $3\frac{1}{2}$ feet

in 40 years. This closely corresponds with the rate of growth given for young trees and coppice shoots in Mr. Gamble's Manual of Indian Timbers, though slightly in excess of that assumed in Mr. Hearle's Working Plan for Jaunsar Bawar.

CHAPTER VII.

WORKING CIRCLES AND THEIR TREATMENT.

I.—Selection Working Circle.

Method of treatment.

37. The object sought to be obtained here is purely preventive. It is essential that the soil covering should be as little interfered with as possible.

38. It is prescribed therefore that each year twelve dead, dying or overmature trees as a maximum shall be removed. The dead trees will naturally be first removed, then the dying ones, and finally the overmature trees such as exist.

After this it is left to the discretion of the divisional officer to open out cover over regeneration when it exists, or to encourage the creation of a young crop by the creation of small blanks. As a maximum however only twelve trees should be cut each year. It is considered that plenty of latitude can be accorded to the divisional officer in this small area, consistent with the object above named.

II.—Coppice Working Circle.

Method of treatment.

39. The object sought here is the improvement of the existing stock and the afforestation of the blank areas, in order to bring the forest into a condition capable of yielding the greatest sustained yield of fuel, and to a certain extent to introduce conifers with a view to supplying, at some future date, timber suitable for building.

40. The method best suited, in view of the object to be attained, is that of "Coppice with standards" accompanied by sowings or plantings in order to assist regeneration. Oak being slow growing except in its earlier years from coppice shoots advantage is taken of its faster growing stage by the adoption of this system. With the exception of the Bihar forest of the Badraj block, there are not many overmature trees in any of the blocks, and the fellings have been arranged so as to include areas containing such trees in the first few coupes to come under working. It is therefore unnecessary to prescribe their removal by a separate series of selection fellings, but any mature Chir trees found in the coupe for the year will be removed if sylvicultural considerations permit.

The exploitable age.

41. A rotation of thirty years has been chosen as the most suitable for the coppice, and for Chir the exploitable girth has been fixed at six feet at breast height. None of the Deodar or Blue Pine will be ready for felling within the period of this plan, and it is unnecessary to fix an exploitable age for these species.

The general working scheme.

42. The coppice with standards felling series will consist of 30 annual coupes, so that, by the end of the time covered by this plan, the whole area will have been once worked over.

The object of reserving standards is to assist in the regeneration by seed as well as to protect the young coppice and seedling growth, and also to avoid, as far as possible, denudation of the surface soil. Moreover without the admixture of trees grown from seed the forest would gradually disappear.

The possibility.

43. No enumerations have been made and the possibility will be by area only, the average size of the annual coupes in the felling series being 86 acres.

APPENDIX D.

Agreement for the lease of unoccupied and forest lands within the limits of the Mussooree Settlement.

THIS indenture made the twenty-eighth day of June nineteen hundred and two between His Highness Rajah Kirti Shah C. S. I. of Tehri Garhwal State (hereinafter called the Raja of Tehri Garhwal) of the one part the Municipal Board of Mussooree (hereinafter called the Board) of the second part and the Secretary of State for India in Council (hereinafter called the Secretary of State) of the third part.

I.—WHEREAS in 1842 Mr. F. C. Wells was appointed special Commissioner by the Government of the North-Western Provinces to investigate the terms in Mussooree and to register and to confirm the existing holdings and to demarcate and to include within the Settlement of Mussoorie land not then included in any existing holding but available for building sites and not then required by the villagers for purpose of cultivation.

II.—And whereas in accordance with his instructions Mr. Wells demarcated and included within the said Settlement of Mussooree certain unoccupied lands which till then had been the property of and within the jurisdiction of the Raja of Garhwal.

III.—And whereas Mr. Wells provided with reference to these unoccupied lands that if any person applied for an allotment of the said land the land applied for should be put up to auction and assessed to an annual rent of one anna a kachcha bigha and that two-thirds of the auction proceeds and two-thirds of the annual rent should be paid to the Raja of Garhwal and his successors in full compensation for all his rights over the land so allotted and that the remaining one-third of the auction proceeds and one-third of the annual rent should be made over to the community for local purposes.

IV.—And whereas the Raja of Garhwal gave his consent to the said rules and provisions.

V.—And whereas the Rajah of Garhwal further agreed that all the lands included within the boundary of the settlement as determined by Mr. Wells and demarcated and surveyed by Captain Browne should be deemed to be within British jurisdiction and to be at the disposal of the British Government for the benefit of the Settlement of Mussooree subject to the aforesaid right to auction proceeds and rent.

VI.—And whereas the rules provisions and principles laid down by Mr. Wells are still operative.

VII.—And whereas in 1867 Captain Montgomeri surveyed the Settlement boundary according to Captain Browne's map and marked the boundary with pillars which are shown on the Great Trigonometrical Survey map.

VIII.—And whereas notwithstanding the arrangement arrived at in 1842 and referred to above certain persons the subjects of the State of Tehri-Garhwal have without the consent of the Board from time to time cultivated portions of the aforesaid unoccupied lands and have grazed their cattle on and taken fuel from the said lands pending their being sold and appropriated under the rules laid down by Mr. Wells.

IX.—And whereas it is now advisable that all the aforesaid lands should be enclosed and constituted a fuel and fodder reserve for the benefit of the Mussooree municipality.

X.—And whereas by an agreement made on the 17th day of October 1894 between the said Raja of Tehri-Garhwal of the one part the said Board of the second part and the Secretary of State for India in Council of the third part the said Raja of Tehri-Garhwal for himself and his successors agreed to grant and transfer to the said Board all his rights of whatsoever kind to and in the aforesaid lands in consideration of the payment to him by the said Board of a sum of Rs. 3,933 in cash calculated at the rate of Re. one annas eight per acre

of the lands forming the subject of the said agreement and an annual payment of Rs. 524-6-6 calculated at the rate of 8 pies per kachcha bigha of the said lands.

XI.—And whereas by clause IV of the said agreement the said Secretary of State did agree and covenant with the Raja of Tehri-Garhwal that should the Board at any time fail to make payment to the Raja of Tehri-Garhwal of the aforesaid annual charge or should the Board be dissolved by order made under North-Western Provinces and Oudh Municipalities Act 1883 or any other corresponding enactment for the time being in force the Secretary of State shall himself be liable to the Raja of Tehri-Garhwal for payment at the appointed times of the annual charge.

- (1) Now this Indenture witnesseth that in consideration of the payment to him of the sum of Rs. 3,933 (the receipt of which the said Raja of Tehri-Garhwal doth hereby acknowledge) and the annual payment to him by the Board of 8 pies per kachcha bigha of the lands the subject of this transfer and in consideration of the hereinbefore recited covenant by the Secretary of State.
- (2) The said Raja of Tehri-Garhwal for himself and his successor doth hereby grant and transfer unto the said Board all the said lands included within the Settlement of Mussooree containing by admeasurement and delineated in the plan and more particularly described in the schedule hereto. Together with all the rights and titles and interest of the said Raja of Tehri-Garhwal to and in the same and all buildings and outhouses gardens ways watercourses easement and appurtenances whatsoever. To have and to hold the same unto and to the use of the said Board for ever.
- (3) And the said Raja of Tehri-Garhwal hereby covenants with the said Board that the said premises shall be quietly entered into and upon and held and enjoyed and the profits received without any interruption or disturbance by the said Raja of Tehri-Garhwal or any person claiming through or in trust for him.
- (4) And further that the said Raja of Tehri-Garhwal and every person claiming any estate or interest in the said premises through or in trust for him will at the cost of the person requiring the same execute and do every assurance or thing for the further or more perfectly assuming all or any part of the said premises to the said Board or by it shall be reasonably required.
- (5) Provided always and it is hereby agreed that with the consent of the Raja of Tehri-Garhwal at any time expressed the Board may commute the aforesaid annual charge for a capital sum of such amount as may be mutually agreed upon and thereupon the annual charge shall cease to be paid by the Board and shall be deemed to have been fully and completely liquidated and extinguished.

In witness hereof the parties hereto have hereto set their hands the day and year first above written.

Witnesses:

(Sd.) J. S. THAKUR.

(Sd.) KIRTISHAH.

(Sd.) BASVANUND GAIROLA.

(Sd.) H. M. LYLE, C. S.,

Superintendent and Chairman,
Municipal Board, Mussooree.

WORKING PLAN

FOR THE

MUSSOORIE MUNICIPAL FORESTS

~~~~~  
1961-1976  
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Compiled in the working plans branch

By

Y. G. RAI., M. Sc., A.I.V.C.

Deputy Conservator of Forests Uttar Pradesh
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NAINI TAL.

WORKING PLANS CIRCLE I. V. T.

90. The working plan prescribed the conversion of the external boundaries of all blocks into fire lines 30 to 50 feet wide, and the making of certain fire lines along prominent ridges. Although the prescriptions were not properly followed, the forests were, on the whole protected from fire with notable success, except during the outburst of incendiarism in 1921, when much of the coppice regeneration got destroyed.

91. Working Plan of Mobbs : 1928-1943.

The revised plan was prepared for a period of ten years from 1929, and in the ordinary course it should have been replaced by a new plan from 1939. The Mussoorie forests were inspected by the Working Plans Conservator in 1936 and upon his recommendations, it was decided not to undertake a revision of the plan, but to extend its period by five years with certain minor amendments. These amendments were sanctioned and came into force in 1937. This plan continued to be in force till its replacement by Ranganathan's plan in 1944.

92. Under this plan, all exploitation fellings were stopped and only cultural operations were allowed. Artificial regeneration on a more concentrated scale was also prescribed. This was considered necessary as a short rotation in the previous plan had resulted in a reduced crop density, that had not been compensated for by regeneration, natural or artificial.

93. This plan contented itself with making changes in the methods of treatment of the existing working circles, but made no changes in their constitution. It even carried on the nomenclature of the working circles adopted in the earlier plan, although the names had become meaningless under the revised prescriptions. Thus two working circles were formed; namely, the Selection working circle consisting of Murray's Springs block, 85 acres in area, and the Coppice working circle consisting of the remaining blocks 2,561 acres in area.

94. In the Selection working circle, the plan prescribed thinnings with the object of improving the existing crop. It also provided for the tending of existing plantations and for the removal of dead and dying trees. Apart from these, no other fellings were to be done in this circle. Murray's Springs block was divided into five approximately equiproductive coupes, each of which was to be felled annually during the first five years of the plan. It was intended that no work was to be done in the latter half of the period of the plan. A set of rules for thinnings were laid down in which the removal of all dead and obviously dying trees, suppressed trees when not required for soil protection, and trees with malformed stems or crowns, whether dominating or dominated, which interfered with the growth of promising trees were prescribed. Dominated trees, as a class, were not to be removed, and in this respect the thinnings were like crown thinnings. The slow expansion of the crowns of banj trees in response to thinnings was stressed, and the need for caution in making gaps in the canopy pointed out. It was prescribed that no trees was to be felled within 30 yards of felled or damaged trees till it was decided to reserve one of the marked trees still standing in its place. Any subsidiary cultural operations were to be done at the time of thinnings. Cleanings in the existing plantations, occurring in the coupe of the year were to be done as required. The planting up of blanks, and open patches in the forests was proscribed, but no attempts were made to all suitable blanks within the first five years of the plan. The entire area of this circle was closed to fire and grazing as before, the fire protection being effected by the maintenance of a fire line 30 feet wide, along the outer boundary of the block.

95. The amendments sanctioned in 1957 effected a number of changes in phraseology and nomenclature, of which the most important was the renaming, for technical reasons, of the Selection working circle as the Murray's Springs working circle. An amended table of fellings was also introduced, which provided for the repeated thinnings of each of the five coupes at intervals of five years. The prescription that the artificial regeneration work should take the form of sowings of hani was also deleted.

96. In the Murray's Springs block, in so far as the intensity of fellings was concerned, there was no marked difference between the prescriptions of Stevens plan and that of Mobbs. The need for extreme caution in making openings in the canopy had been stressed by both the plans. The significant improvement in the methods introduced by Mobbs was that the fellings should serve silvicultural and not exploitation purposes. In other words, only thinnings were to be made in addition to the removal of dead and dying trees. In view of general immaturity of the crop at the time and the need for relieving congestion, these prescriptions were essential. The plan did not aim at producing natural regeneration through the manipulation of fellings. The crop undoubtedly benefited from these thinnings which were on the whole, well carried out. Artificial regeneration work was not very successful.

97. The Coppice working circle with a total area of 2,561 acres comprised of all the municipal forests with the exception of Murray's Springs block. Its constitution was thus exactly the same as in the previous working plan, despite the fact that no coppice fellings were proposed. The thirty annual coupes into which the seven separate blocks falling within the circle had been divided were now converted into the same number of compartments with hardly any changes in the boundaries. Thus all the large blocks were divided into consecutively numbered compartments and the smaller ones were left undivided as single compartments. The old coupes in each block did not bear numbers in serial order, but the numbering was continuous over the whole working circle.

98. Out of 30 compartments, 22 with a total area of 1,880 acres had been felled under the Coppice with Standards Working Circle, leaving a balance of 8 unfelled compartments with an area of 681 acres. The unfelled compartments were Tonatu 1 and 2, Loti Kimoin 4, 10 and 11 and Binog 5, 6 and 7. As, however, the first working plan had so arranged the sequence of fellings that the poorest and the most open areas were put down for fellings in the last years of its period, the difference between the felled and unfelled compartments in density and maturity of crop was not as great as might have been expected. In both the types of areas, the prime need was for tending and for restraint in fellings. Some differences in the proposed treatment were indicated and accordingly the plan formulated two separate series of coupes. The work to be done in both these classes was actually very similar and was termed improvement operations. All further coppice fellings in the working circle were stopped.

99. In the unfelled compartments, the operations were to take the form of improvement fellings, including ordinary thinnings where required, while in the felled compartments, the operations were to consist of cleaning the shrubby undergrowth, thinnings in dense coppice, removal of large standards suppressing coppice or regeneration and general tending of existing plantations.

APPENDIX VI

Forest Department G.O. No. 859/XIV dated December 15, 1933, notifying the management of Bhilaru block as Reserved Forests.

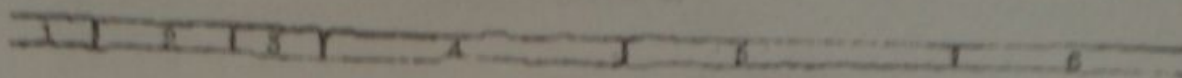
WHEREAS a representation in writing has been made by the City Board of Mussoorie to the Collector of the Dehra Dun district that the land more particularly described below, of which the said Board is owner, may, with a view to the formation and conservation of forest thereon, be managed as reserved forests under the provisions of the Indian Forest Act, 1927.

Now in exercise of the power conferred by section 38 of the said Act, the Governor in Council is pleased to declare that the following provisions of the said Act shall apply to the said land with effect from the date of this notification, viz. section 2 of Chapter I, sections 25 and 26 of Chapter II, all sections of Chapter IX, section 70 of Chapter X, section 72, 73, and 74 of Chapter XI, and sections 82, 83 and 84 of Chapter XIII.

The Governor in Council is further pleased hereby to declare that the Chairman of the Mussoorie City Board shall be the Forest Officer in the Municipal Forests within the meaning of section 2 noted above, in order to manage that forest under the provisions of the Indian Forest Act, 1927, as specified above and to invest him with the powers described in section 68 of the said Act.

Description of boundaries of the Bhilaru Block, Area 46.5 acres.

| Name of reserve | Civil district and its sub-division | Serial number of pillars | Boundary description                                    |                                        | Remarks |
|-----------------|-------------------------------------|--------------------------|---------------------------------------------------------|----------------------------------------|---------|
|                 |                                     |                          | Situation of pillars                                    | Nature of boundary line to next pillar |         |
| 1               | 2                                   | 3                        | 4                                                       | 5                                      | 6       |
| Bhilaru         | Dehradun                            | 1                        | On the edge of road leading to Bhilaru pumping Station. | A prepared path 3 feet wide.           |         |
|                 |                                     | 2                        | Near the crest of a spur.                               | Ditto.                                 |         |
|                 |                                     | 3.                       | On a spur near Bhilaru septio tank                      | Ditto.                                 |         |
|                 |                                     | 4.                       | Near the crest of a spur.                               | Ditto.                                 |         |
|                 |                                     | 5.                       | Ditto.                                                  | Ditto.                                 |         |
|                 |                                     | 6.                       | Ditto.                                                  | Ditto.                                 |         |
|                 |                                     | 7.                       | Ditto.                                                  | Straight line.                         |         |
|                 |                                     | 8.                       | Ditto.                                                  | Ditto.                                 |         |
|                 |                                     | 9.                       | Ditto.                                                  | Ditto.                                 |         |
|                 |                                     | 10.                      | Ditto.                                                  | Ditto.                                 |         |



- |     |                                                  |                                                       |
|-----|--------------------------------------------------|-------------------------------------------------------|
| 11. | On a spur                                        | Straight line.                                        |
| 12. | On a rocky knoll                                 | Ditto.                                                |
| 13. | On a knoll                                       | Ditto.                                                |
| 14. | Just below the junction of two watercourse.      | Up the southern water course.                         |
| 15. | On the edge of Bhilaru pumping Station road.     | South-eastwards along the road.                       |
| 16. | At the edge of the Bhilaru pumping Station road. | Straight line.                                        |
| 17. | On a watercourse                                 | Up the watercourse.                                   |
| 18. | On the watercourse near a suspension bridge.     | Along the Sewer line north-westwards to pillar No. 1. |
| 1   | The Starting point.                              |                                                       |

By order,

H.A. LANE,  
Secretary to Government, United Provinces.



### MUSSOORIE ELECTRIC SUPPLY.

Mussoorie derives its electrical energy for lighting and power purposes from the Generating Station, situated at Galogi, which also supplies current to Landour, Rajpur and Dehra Dun. Water for driving generators is taken from the Kiarkuli and Bhatta streams at their junction and conveyed through steel pipes to the power house, the total working head being 1,000'. Current is generated at 6,600 volts which is reduced to a working pressure of 380 volts for power and 220 volts for lighting. Consumers are charged As. 6 for light and for power, from A. 1 to As. 5 according to the amount used. The undertaking is one of the best in India and forms the chief source of revenue of the Board.

### WATER WORKS.

The Mussoorie Water-Works are electrically operated. At the present moment there are two pumping stations working. The Main Pumping Station is situated below the Mackinnons Brewery. The supply of water is derived from the Murray Springs conveyed to the collecting reservoir at the pumping station and pumped up 1,700 feet to reservoirs of 3,000,000 gallons capacity situated on Vincents Hill. The water, which is of excellent quality although somewhat hard is not exposed to daylight from the moment it leaves the springs until it flows from the taps, and as the springs are very deep seated, filtering and boiling are absolutely unnecessary. A fair idea of the depth of the springs may be formed from the fact that when the rains commence there is no increase in their discharges until over thirty inches of rain have fallen. The plant of the main pumping station consists of two 150 H. P. motor driven steam pumps, delivering 180 gallons per minute.

The "John Mackinnon Spring" is pumped up to a reservoir at the Library by electrically driven pumps operating against 600' head. From this station water is supplied to all houses below the Mall level.

Work has been commenced on a new pumping station at the Bhilaru Springs below Camels Back and will be completed in time for the season of 1923-24. This with certain other minor extensions will bring the supply of water up to 26 gallons per head of population which is probably the biggest allowance for any hill station in India.

*Hydro-electric scheme*—Up to 1909 the water supply of Mussoorie was provided partly by gravitation from the Chalmer Khad and Khattapani springs and partly by steam pumping from the Mackinnon spring below the Library. Of late, however, it had been recognised that the supply was quite inadequate to the demand, and in 1900 the question of the provision of a further supply was seriously taken up. In October 1902, the Sanitary Engineer, Mr Aikman, presented a preliminary report and estimate for improving the Mussoorie and Landour water supply, coupled with a scheme for lighting both places by electricity. The general plan of the scheme was that power should be derived from the Kempty Falls and utilised firstly to drive electric pumps, which would pump up water from the Murray springs for the supply of Mussoorie, with subsidiary pumps for Landour, and secondly to light the streets, public institutions, hotels and private houses in Mussoorie. The cost was tentatively estimated at Rs 6,50,000, and a detailed scheme was worked out but unfortunately the negotiations with the Tehri Raja for the use of the Kempty Falls fell through, and the Board chose as a substitute the Bhatta Falls on the south face of the Mussoorie ridge, which had the advantage of being situated both in British territory and also nearer the rail head at Dehra. Some further modifications were introduced into the scheme, on the recommendation of Major DeLotbiniere, who was called in to advise in September 1904. The final estimates as sanctioned by the government in March 1905 came to Rs 7,29,560 for Mussoorie and Landour. The Landour portion of the scheme was, however, subsequently dropped as the Cantonment authorities withdrew from participation in the scheme shortly after the final estimates had been passed. The general plan of the scheme is as follows:

About two miles below the Mall and to the south of Mussoorie, near Bhatta village, two mountain streams join forces. Just below this junction are constructed the necessary headworks,

which control the flow of water from these streams into the steel pipes through which the water will flow to the generating station. The latter is situated at Galogi, approximately one mile below the headworks. The generating station comprises three generating sets of 150 kilowatts each, the generators being alternating three phase, 50 cycle, 6,600 volt machines directly coupled to Pelton wheels, each set being controlled by a Lombard governor. These machines are connected to the necessary switching apparatus fixed on the switchboard, whence two sets of high tension lines issue forth on their way to the pumping station, the one running over Vincent's Hill, feeding two sub-stations, while the other wanders right through Mussoorie from Barlowganj at the one end to Herne Hill at the other, and feeds ten sub-stations. Several springs situated in the Murray estate have been impounded for the supply of water which is led through pipes to a reservoir hard by the pumping station. The latter is situated about one and a half miles below the Old Brewery and contains two three-throw pumps rope-driven by two motors of 150 horse power each. The water is lifted, at the rate of 180 gallons a minute, some 1,700 feet, to the topmost point of Mussoorie, Vincent's Hill, where are situated two reservoirs of 50,000 gallons capacity each. Thence, the water flows by gravitation to all parts of the station.

The secondary portion of the scheme provides for the lighting of all roads in the station. The Mall is to be lighted by means of 2,000 candle power arc lamps and other roads by means of 32 candle power incandescent lamps. The station has been divided into twelve approximately equal areas. At the centre of each area is fixed a transformer station, or sub-station. In each of these suitable apparatus transform the high tension pressure of generation to low tension pressure of 220 volts, suitable for a supply to the public, and from each sub-station issues a network of wires, some of which convey the current to the public lamps while others will convey it to private houses.

Electric energy is sold at the rate of four annas per B.T.U. (Board to Trade Unit), while the water is obtainable through a meter at the rate of two rupees per 1,000 gallons if supplied through house connections; at the public standposts, the supply is free.

The scheme is in many ways unique. The lift of 1,700 feet is certainly the highest lift in Asia and one of the highest in the world. The laying of the power pipe line is an exceptionally fine bit of work. The line, instead of running straight as most large power pipelines do in Europe, has to follow the contour of the hills. The survey of this line and the calculations involved so as to make sure of getting the right angles in the bends were of a most difficult nature. Great credit is due to Mr Pitkeathly, the contractors' chief engineer, who almost sacrificed his life in his endeavours to complete this pipeline in time for the scheme to be opened in 1909. The actual cost of the scheme has far exceeded the final estimate of 1905. In 1908, the revised estimate for the completion of the scheme had risen to Rs 9,72,000 for Mussoorie alone—an increase of some forty percent, on the original estimate. In the end the government granted a subvention of Rs 25,000 for six years to the municipal finances, in order to assist the board in defraying the charges due for interest and sinking fund on the loans incurred, until the scheme commenced to pay its way.

Commenced in January 1906, the scheme was practically ready for working by May 1909. The new hydrants were opened for public use on the fifteenth of that month. On the twenty-fourth—Empire Day—the electric light was switched on with some éclat for the first time. Since then the lighting and water services have been conducted with but few hitches. Experience has, however, shown that arc lamps are ill-suited to road lighting in a hill station, and they are being replaced by incandescent lamps on the Waverly Road between the Library and Charleville Hotel. The only serious interruption which occurred was that caused by the heavy floods of 11 August 1909. These breached

the paved pipe line in two places and damaged the terreplein on which the power house is situated. Temporary repairs were effected within a fortnight, but the permanent repairs are still under construction and are estimated at Rs 75,000. By the time, therefore, that the scheme is finally completed the total cost will probably have amounted to not less than eleven lakhs and may possibly come to more. Even to repay the interest and sinking fund charges on this sum at six percent, an income of Rs 66,000 per annum would be required—which is scarcely within the bounds of proximate probability. The anticipations of speedy profit which were entertained at the time of launching of the scheme are therefore never likely to be realised. At the same time the Board is taking active steps to promote light and water connections, and expects to have a hundred houses at least on its mains when the 1910 season opens. The income from these connections will be considerable. While it is improbable that the scheme will, at any rate for many years to come, be a commercial success, it is quite possible that in the near future, the net cost of the scheme to the rates, will, after deducting the income derived from house connections, not exceed the amount paid by the Board for the vastly inferior lighting and water supply which prevailed prior to 1909.

*Municipal area*—The present municipal boundary was entirely revised in the year 1903 and the total area within the revised limits is about 12,280 acres or nineteen square miles. The Landour bazaar which was handed over to the Municipality by the Cantonment authorities in the year 1897 is included in this area. It is to be noted that Bhadraraj although municipal property, by virtue of the transfer by the raja of Tehri in 1894 of his interests in the 'Tehri unoccupied lands', has been outside the municipal boundary since 1873. In Major Brown's time (1842) Mussoorie's area was 17,473 acres or twenty-seven-and-half square miles. The difference is due to the exclusion of Rajpur and the land south of the toll gate and of Chamansari.