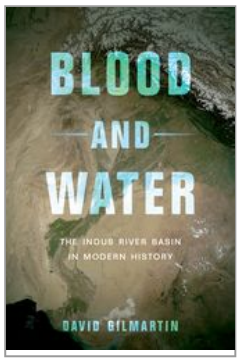

Blood and Water: The Indus River Basin in Modern History
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Science, the State, and the Environment

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[–] Abstract and Keywords

A new engineering approach to irrigation marked the last decades of the nineteenth century. This was the era in which engineers increasing sought to make use of water to maximize its command over “wasteland.” One result of this was the opening of the Punjab canal colonies, where previously uncultivated (or intermittently cultivated) lands were settled by agricultural colonization. This process went hand-in-hand with a systemic vision of the river basin, which underlay increasingly large projects for moving water from one tributary river to another. But continuing contradictions within British policy-and a political reliance on the genealogicallyimagined village-produced considerable friction and ultimately led to widespread protest against government policies in the early twentieth century.

Keywords: water engineering, Punjab, canal colonies, agricultural colonization

> *Engineers in general do not talk much; with becoming modesty, they are content to let their achievements speak for themselves*.
>
> —PUNJAB PUBLIC WORKS DEPARTMENT, *MANUAL OF IRRIGATION PRACTICE*[1]
>
> *Rain came from above as God willed it, in plenty or otherwise, and nobody could stand face to face with God and demand adequate rain, but one could go up to a canal officer and demand water; all he had to do was enlarge the outlet*.
>
> —PRAKASH TANDON, *PUNJABI CENTURY*[2]

The appeal to science as a frame for both environmental transformation and new claims to state power was, in the last decades of the nineteenth century, not new. But in the years from 1860 to 1890, it was not science but law that was the major obsession of British administration in the Indus basin as the British sought to bring order to India and morally legitimize the power of the British state. As we saw in chapter 4, rationalizing legal statutes (such as the 1873 Canal Act) provided the major levers through which the colonial state defined itself as a modernizing,

developmental agent, even as the state balanced this with legal appeals to “custom” in an effort to shore up the indigenous foundations of its own legitimacy. But in the last decades of the nineteenth century, science began to play new roles in shaping British efforts to directly transform the Indian environment, provide new sources of revenue, and define new claims to state power. State control over irrigation was increasingly seen as linked to the state’s power to transform the physical environment of the Indus basin itself. This was hardly a development independent of the structure of law, but it represented an effort to sidestep, in effect, many of the contradictions embedded in the conceptual structure of the law (which we saw operating in the previous chapter) through direct state action on the physical environment itself.

There were significant parallels between law and science as frames for the legitimizing claims of the colonial state in the late nineteenth century. Perhaps most **(p.145)** important, both were conceptualized as realms of power that stood apart from everyday politics and from the forms of “natural” local, kinship-based allegiances that defined particularistic loyalties. Both law and science justified the state’s dominance through an appeal to principles of impartiality and detachment on the part of the rulers, whether linked to a “rule of law” that theoretically transcended the self-interest of political power, or to a commitment to science and technology linked to a scientific “temperament” dictated ultimately by rational adaptation to nature’s own independent laws. Though building on parallel conceptions of state authority, law and science defined different frameworks for encapsulating local forms of politics and community within larger frameworks of state control and administration. New technologies of environmental control linked to science did not displace the old structures of legal authority that lay at the heart of colonial statecraft, nor did they displace the linking of individual property to village genealogies of “blood” as the colonial revenue order had been mapped on the land. But they layered onto these forms a powerful new structure of state authority, encapsulating newly settled communities within a vast structure of canal works physically “commanding” the Indus basin’s “wastelands” on a previously inconceivable scale—and defining them as subject to a larger environmental “system.”

In technical terms, what marked the period after 1890 as a new era in canal building was the growing domination in Indus basin irrigation works of perennial rather than seasonal canals. Perennial canals flowed year-round and were controlled by permanent weirs on the rivers. They were hardly new in the region in these years.[3] But their relative domination over seasonal canals was linked in this era to an emphasis on carrying water to arid “wastes” that had not historically been reachable by inundation canals. The new era was thus defined not just by the dominance of perennial canals but also by the large-scale agricultural colonization of previously uncultivated (or intermittently cultivated) lands, leading to the agricultural colonization of vast new canal colonies in the Punjab and (to a considerably lesser extent) Sind.[4] This was an era marked also by the emergence of new visions of environmental control tied to the growing professionalization of water engineering.

Engineers and Water Control

The origins of this shift lay not initially in any grand plan but in ongoing adaptations to the problems inherent in dealing with the highly seasonal character of Indus basin flows—and of the problems of canal administration to which the problems of seasonality had given rise. This was evident in the history of the Chenab canal, whose story tracked the critical transition in Indus basin irrigation during these years. The Chenab canal was originally constructed in the 1880s as an inundation canal, with little relationship to (or thought of) large-scale colonization in the high *bar*. But problems in silting so limited the Chenab canal’s initial **(p.146)** workings that

engineers proposed dealing with the problem by constructing a weir on the Chenab river to raise the water level and improve the flow. The construction of a weir, however, raised new problems. Silting and variable seasonal flow had in the past made it impossible for inundation canals to sustain significant permanent settlement in the large government wastelands of the central Punjab *bars*, since neither rainfall nor wells were adequate in areas of such low water tables to sustain a permanent population when the canals seasonally ran dry. But if the government were now to recoup the costs of the new Khanki barrage, the calculus of the Chenab canal would have to be changed. Indeed, to make the barrage pay, the Chenab canal would need to be significantly enlarged and pushed deeply into the unsettled interior of the Sandal *bar*. The key was the linking of a new, perennial water supply on "wastelands" to large-scale agricultural colonization.

From these considerations, the Chenab canal thus evolved into the large-scale spine of the first great Punjab canal colony. In spite of some earlier attempts at agricultural colonization on the Sidhnai canal in Multan, the linking of the Chenab canal to the large-scale settlement of the Sandal *bar* marked the true beginning of a new era in landscape transformation when the Chenab colony officially opened in 1892. With an annually irrigated acreage that eventually approached two and a half million acres (or approximately 3,500 square miles), the Chenab colony became, in the words of a government of India review of irrigation in 1918, "easily the most productive work in India," with a financial return on investment of almost 40 percent annually. The opening of the Jhelum colony in Shahpur district in 1902 followed quickly on the Chenab colony's heels. These models led ultimately to the huge Triple Canal project, completed in 1915, which brought water through link canals from the Jhelum and Chenab rivers to settle the "wastelands" of the Lower Bari Doab colony in the high *bar* of Montgomery and Multan districts—and in the critical connection of this large colonization to the emerging engineering view of the Indus rivers as an interlinked system. By 1918, the number of acres irrigated by government canals in the Punjab had increased more than six-fold over what it had been forty years earlier[5] and, more importantly, had defined a dominant new pattern of canal development that would change the history of Indus basin irrigation irrevocably.

The evolution of this pattern was linked in critical ways to the piecemeal development of efforts to deal with the Indus basin's seasonal dynamics, but it was also a development connected to newly emerging scientific emphases in the professional development of water engineering. Perhaps equally as important, these influences shaped new *spatial* visions of power in its relationship to state administration and control. Spatial units of land were increasingly framed within the new canal colonies not just by law and village mapping (though these remained important) but also by their place within a simultaneously natural and engineered river basin. Irrigators' fields and village boundaries were drawn within the colonies **(p.147)** largely in accord with the engineered lines of branching canals and surveyed squares, whose meaning and authority derived not primarily from law (or history) but from a new system of engineered canal networks that tapped and channeled nature's energy for productive purposes. Local canal networks were also increasingly envisioned as part of an interlinked whole in which no canal could be imagined as operating entirely independently of the flows feeding other canals.

In the process, a new era of canal development held out the promise of a different sort of "community" of production rooted in the preeminence of engineering. "Technology," as Gyan Prakash puts it, "forged a [new] link between space and state,"[6] defining a vision of state power linked to control over the physical landscape itself, and characterized by the encapsulation of individuals and communities, not just within frameworks of property and law but within

engineered water flows. Whatever the connections between rationalized management and the legal structure of the Canal Act, this was an era defined by a new vision linking engineers and irrigators alike in a community of production shaped by the contours of nature itself—a vision with the potential to reshape relations between state and society.

The Professionalization of Irrigation Engineering

The increasing importance of an engineering worldview in shaping water development in this period requires a brief foray into the intellectual and institutional history of nineteenth-century engineering. The professionalization of engineering in India can perhaps best be dated from the founding of two key educational institutions in the mid-nineteenth century: the College of Civil Engineering at Roorkee, northeast of Delhi (founded in 1848 and renamed the Thomason College of Civil Engineering in 1854), and the Royal Engineering College at Cooper's Hill in England, founded in 1870 with government of India funding.[7] These schools were hardly equal; reflecting the racial hierarchies of colonial administration, Cooper's Hill graduates were given higher pay and better access to positions than those trained at Roorkee, whether Indian or European.[8] Yet in some respects the colonial roots of both Roorkee and Cooper's Hill helped to foster the emergence of a distinctive professional ethos in British engineering that transcended these divisions and shaped an emerging vision of engineering as a "public" profession.

The key to this lay in the linking of professionalization with service to the colonial state. As Richard Temple noted in the 1880s, Britain had long held a reputation for backwardness in technical education as compared with the countries of continental Europe, since engineering instruction, geared toward private employment, tended to be conducted in "private establishments at the industrial centres of England." The only important exception to this was in the military.[9] But by the last decades of the nineteenth century, the British government in India had come to have such "colossal interests at stake in its public works," as Temple wrote in 1883, **(p.148)** that this structure was being transformed. With a growing need for well-educated engineers and with "immense resources for so arranging its plans that this object shall be secured," the structure of colonialism itself played a central role in shaping new forms of engineering education.[10]

The joining of the prestige of mathematical science with the prestige of state service was key to the educational experience at both Roorkee and Cooper's Hill. As a Punjab Irrigation Department manual later suggested in tracing the development of irrigation engineering in the Punjab, earlier military engineers had no doubt worked with "amazing courage and resources." But "their knowledge of irrigation and hydraulics was *nil*." The mid-century Bari Doab and Sirhind canals had thus been built with "beautifully drawn and skillfully colored plans" but with "shocking mistakes of design" that had been corrected only by dogged persistence.[11] By the 1880s, however, the new educational institutions had changed this. For students themselves, the effects of this education were often transformative. Cooper's Hill, as Temple put it, taught not just technical skill in engineering but also the "moral training" and "discipline" that would prepare students for "victorious success" in controlling the world.[12] At Roorkee, as William Willcocks later wrote, "we were taught on the sound lines of the Ecole Polytechnique in Paris, and not on the ridiculous lines generally in vogue in England at the time." Professors at the college had aspirations for "world-wide science."[13] For Indians such as Ram Das Tandon, who graduated in 1898 and joined the Punjab Irrigation Department, the process of becoming an engineer at Roorkee was like passing through a transformative "dream," defining an entirely new "public" identity.[14] With the engineering profession now "on its feet," many engineers could cultivate a selfless, scientific self-image; they were "content to let their achievements speak for

themselves" (as the Punjab *Manual of Irrigation Practice* put it in this chapter's epigraph), even as they identified strongly with the "public" power of the colonial state.[15]

Water's Duty: The Language of Engineering Control

To understand this new ethos—and its political implications—it is important to take a brief foray into the language of engineering and its metaphorical views of nature's control. As the inspector-general of irrigation in India put it in 1920, "exact terminology" was "the first essential to sound progress in any special work of a scientific character."[16] Perhaps no single term was more redolent of the underlying assumptions that shaped water engineering in the late nineteenth century than the concept of water's "duty." In its everyday usage, the term "duty" captured the sense of moral responsibility and civilizing mission associated with many of the new emphases in engineering education. In the colonial context, it was a term that harked back to the sense of imperial mission embodied by men like Sir Robert Sandeman. But, in the context of professional engineering, "duty" was a term applied directly to water, and it signaled the power of engineering knowledge to make nature complicit in man's purposes.

(p.149) In technical terms, "duty" was a measurable quantity; it defined "the relation between the volume of water and the area of crop which it matures." Though its precise measurement varied somewhat in different contexts, it was usually expressed in India in terms of the number of acres of cropped land that a cubic foot per second (cusec) of water could be expected to bring to maturity in a particular period of time: thus, "if 1 cubic foot a second running continuously for four months will mature 100 acres of crop, the 'duty,' in that case, is said to be 100 acres to the cusec, to the base of 4 months."[17] "Duty" was thus a fundamental measure of the ultimate goal of irrigation science—the extraction of productive capacity from water. As Herbert Wilson noted in a leading irrigation textbook of the late nineteenth century, "[O]n the duty of water depends the financial success of every irrigation enterprise, for as water becomes scarce its value increases. In order to estimate the cost of irrigation in projecting works, it is essential to know how much water the land will require. In order to ascertain the dimensions of canals and reservoirs for the irrigation of given areas the duty of water must be known."[18] Duty was, in other words, a measure of the "work" that, with man's guidance, nature could perform.

The centrality of "duty" to late nineteenth-century irrigation engineering had roots in broader shifts in nineteenth-century scientific thinking about nature. As M. Norton Wise and Crosbie Smith have argued, the middle of the nineteenth century had witnessed a fundamental shift in the dominant view of nature among scientists—from one stressing a "balance" of natural forces, tending toward timeless equilibria, to one that stressed the importance in nature of perpetual change and of the tendency of natural systems to move relentlessly toward energy dissipation.[19] This was the context in which the term "duty" gained currency. In origin, the term was first technically applied in Britain as a measurement for assessing the efficiency of steam engines. As used by James Watt in the late eighteenth century, for example, the efficiency of a steam engine in pumping water was measured by the "duty" (or work) it could perform: the number of pounds of water that the engine could raise one foot per bushel of coal as fuel.[20] "Duty" was thus rooted in the concern for the efficiency of energy use within a mechanical system, and its usage in irrigation engineering reflected a powerful view of canal systems as metaphorical "engines" or "machines" within which the conservation of energy—and the control of "waste"—was central. "We may look on [the canal] as a great machine composed of many parts," J. S. Beresford wrote in 1875 (of the Ganges canal), "and go about calculating its efficiency much in the same way as that of a steam-engine."[21] Using the same language, R. G. Kennedy attempted to calculate in the 1880s the duty of the Bari Doab canal measured from its offtake at Madhopur, taking into

account the water losses that occurred in its various parts, and concluded: “Considering the canal as a machine, its efficiency was 28%” (that is, only 28 percent of the water taken off at the head reached the root zone of plants to perform its work).[22] **(p.150)** Such statements reflected the central imperative of late nineteenth-century water engineering. Any water engineer “should begin with the principle,” Bruno Latour writes, “that if water can leak away, it will.”[23] It was this preoccupation—with thwarting the natural tendency toward waste—that defined both the mission of most irrigation engineers and their discipline as a mathematical craft.

“Commanding” the Land

This preoccupation was dramatized most clearly by the science of water flow, which was the key to making water perform its agricultural work on the land—and to the definition of a new spatial vision of the environment linked to these principles. By modeling and measuring water flowing through an interlocking system of rivers, canals, distributaries, and watercourses, irrigation engineers increasingly imagined themselves as managing a hydraulic *system* composed of innumerable discrete but interlocking and measurable parts. This was the irrigating “machine” that science has called into existence. But these parts were not simply man’s creation; they mirrored the structural features shaping water’s flow within the river basin itself as a *natural* system. The aim was that, with man and nature aligned, water could thus be made to “command” the land for agricultural purposes. The role of science was to tap into and channel nature’s own independent energy.

Each structure of water delivery was thus (in emerging engineering theory) linked to every other structure, and each was, in turn, linked to measurable units of “commanded” land, which provided the frames for water’s work. The term “command” was, like “duty,” a piece of technical engineering jargon that helped to forge the alliance between man and nature by metaphorically imputing human characteristics to water. In engineering jargon, it was not water that was to be “commanded” but water itself that was, with man’s assistance, to “command” the land. The “command” of a particular canal referred, in technical parlance, to the (measured) area of land that could be reached through gravity flow by water from that canal. Water’s “duty” could thus only be fulfilled when the land was brought under canal “command.” Indeed, the term operated on a hierarchy of levels, as the “command” areas of the smallest channels were nested within the “command” areas of larger distributaries and canal systems. These interconnections suggested how the control of flowing water encompassed also a system of nesting units of land, reaching down (in theory) to the fields of every water user, all “commanded” by canal systems.

Although the science of water flow (hydraulics) was a universal science, the application of these principles in the Indus basin was shaped by its own distinctive environmental conditions. The defining features of the Indus rivers were, of course, their highly seasonal flow and their heavy silt load. Maximizing “command” meant neutralizing the variations in seasonal flow, and as a result the overwhelming focus **(p.151)** of the new engineering science was on perennial canals, which ran year-round by capturing the low seasonal flow in Punjab’s rivers behind large weirs, whose shutters were raised to let high water pass through during periods of flood. Canal levels were controlled—unlike on inundation canals—by head regulators.[24] Though engineering management continued to focus on reforms in inundation canal operation, cutting-edge professional engineering was seen now to focus almost exclusively on perennial canals. Some leading engineers, such as S. L. Jacob, former chief engineer of the Punjab, referred to canals subject to seasonal flow as only a vestige of “an early stage of civilization” that would be gradually replaced by perennial works.[25] In such a worldview, the remaining seasonal canals

(though still of local importance in some areas) were increasingly dismissed with the moniker “minor canals.”

Far more central from a scientific, hydrological perspective were the problems posed by the Indus basin’s heavy silting. In engineering terms, the problem of silting was (at least) two-fold. First, silting and scouring processes significantly complicated the mathematical modeling of flow in canal channels as parts of interlocking hydraulic systems. Engineers had long sought to calculate the water flow needed in each channel so that the capacity of the channel would be “exactly proportional to the duty to be performed” at each outlet, as this was essential to applying water systematically to bounded pieces of land.[26] But heavy silt loads vastly complicated this process. More critical was a second problem, that of silt accumulation in channels, which was historically linked to the need for annual labor mobilization for silt clearance. The requirement for such labor mobilization seemed to compromise the claims of “modern” irrigation science to transcend the local political entanglements long associated with labor mobilization and thus to define the power of engineering knowledge to operate independently of local politics. Solving the problem of silting was a critical measure of engineering’s ability to transcend its own Indus basin past.

An engineering breakthrough with implications for silt clearance on perennial canals had occurred on the Bari Doab canal in the 1880s. R. G. Kennedy, later chief engineer of the Punjab, was the first to propose a mathematical theory for flow modeling in unlined channels that would allow engineers to obviate (at least in theory) the need for annual silt clearances. Based on empirical observations on the Bari Doab, he defined a formula for what he called “regime channels,” or canal channels in which silting would in theory come to balance scouring over prolonged periods of operation. This would allow canals to be designed so that they would evolve toward their own self-regulating “regime.” Kennedy’s formula, though later much modified (most importantly with the introduction by Gerald Lacey in the 1930s of a factor for the size of silt), had by the turn of the century laid the foundations for major shifts in Indus basin canal design and flow management.[27] “Regime channels” of course still required careful monitoring and sometimes the periodic **(p.152)** remodeling of outlets to maintain design specifications at each outlet as a canal “found” its regime.[28] As one engineer commented with respect to such channels, “An irrigation system in its parts comprises a very delicate machine, and these several parts constantly require adjustment and overhauling; to deprive the machine of these adjustments can only spell immediate loss of efficiency and in a very short time disaster.”[29] Such monitoring—and particularly outlet remodeling—was itself a periodic source of irrigator protest, as we shall see. Nor, in the end, did a focus on canal “regimes” obviate altogether the need for occasional canal closures and silt clearances in perennial channels. But the mathematical definition of “ideal” regime channels in which silting balanced scouring at prescribed canal slopes was nevertheless critical in facilitating the engineering agenda of gaining “objective” control over channels and freeing canal management from the periodic mobilization and management of irrigator labor, which, more than any other aspect of Indus basin canal history, linked back to a world of “custom” and local social organization. The aim was now to control the problems of silting and differential flow not by mass labor mobilization or by the mobilization of local “community” but by understanding nature sufficiently fully that science could tie itself to nature’s own “regime.”

Modeling and controlling the flow in channels was, of course, only the first step in defining a hydraulic system that encompassed the irrigation of the Indus basin. The interface between regulated water flow and measured quantities of commanded land was also critical, for this was

ultimately the key to water's interface with the structure of property—and to the measurement of water's duty. Canals in the mid-nineteenth century had often delivered water to villages through open, uncontrolled cuts, but the establishment of departmental control over outlets had already emerged as an important legal principle in the 1873 Canal Act.[30] With advances in engineering theory and control of flow in channels, control over outlets became all the more critical as agricultural colonization developed. Considerable engineering attention was thus devoted in the late nineteenth and early twentieth centuries to the design of "modular" outlets that could effectively regulate the flow into irrigator watercourses, independent of any actions taken by the irrigators themselves. Irrigators had long sought to increase the supply from outlets not only by "tampering" but also by deepening their own watercourses to improve the draw. Central to engineering imperatives was thus the design of self-contained "modules" that could deliver water independent of such pressures. As K. R. Sharma later described the problem in an engineering textbook: "The supply drawn by a non-modular outlet is forever changing independent of surface level in the supply channel [due both to irrigator action and changing natural circumstances in watercourses], and thereby affecting the general distribution of supply in a manner entirely beyond the control and management of those responsible for distribution." The goal "on a moduled channel," Sharma wrote, was therefore to arrange the distribution "entirely independent of the arbitrary changes in watercourse conditions" **(p.153)** so that it would be "dependent only upon conditions in the supply channels under government control."[31] The design of modular outlets—though a long and difficult process[32]—thus went hand in hand with the engineering concern to mathematically match water to the particular measured pieces of land, a practice called *chakbandi*.

No one imagined, of course, that this could be done independently of local conditions, whether natural or social. Calculating the proper full supply to deliver water in new channels itself depended on innumerable mathematical and local variables. As Sharma wrote, "The relation of water supply to the land depends on the rainfall" and on "the composition of the soil." It depended on the crops to be grown and on the skill and character of the cultivators. But these variables could all be captured (at least theoretically) through the calculation of different values for water "duty" under such differing conditions. Since the projected duty of water varied with the crop, engineers calculated the water requirements (and numbers of waterings) of each expected crop. These were then combined with a determination of the irrigating "intensity" on each distributary (that is, the percentage of the "commanded culturable area" that was to be irrigated in a particular season) in order to determine the quantity of water needed in each canal.[33] At the same time, planning for each channel took into account the water demands for different crops at different times of year. Finally, chakbandi statements were prepared for each outlet, suggesting the total outlet discharge required for each measured area, or chak. Putting this together gave the "full supply factor" for the channel and dictated its design parameters. Engineers were expected to work out all of this mathematically, as a prelude to making sure, once channels were built, that they operated according to specifications.[34]

All of this, of course, was in perpetual tension with the realities that many engineers encountered on the ground. As T. R. J. Ward put it, "The indoor [or office] functions of the Punjab irrigation officer with regard to the allocation of the supply would seem to consist of simple arithmetical calculations." But the "outdoor" functions involved "work that will insure that the channels in his charge distribute this supply equitably."[35] Though newly minted engineers had to learn the formulas for all these variables, most were well attuned to the importance of local conditions—and sometimes to "local knowledge" as well. As Michael Lewis has argued, this was an important element in the training of many engineers.[36] Whether in the development of

effective modular outlets or in the operation of regime channels, irrigation engineers were well aware of the ongoing problems in realizing in operational terms the mathematical goals that defined their science. As one engineer admitted in 1913, the use of outlets to match flow to irrigated areas was often, in practice, as much a matter of trial and error as of "mathematical precision."[37] Projections of crop percentages and irrigation intensities gave no guarantees that these levels would actually be reached. Senior engineers knew well the range of political and **(p.154)** administrative constraints that intruded on canal operation, whether in matters of bureaucratic corruption,[38] water pricing,[39] or even, in some cases, basic projections of water duty.[40] But the mathematical modeling of hydraulic variables nevertheless took on new importance by the turn of the century, shaping a vision of the Indus basin water system as an environment of discrete interrelated parts, a vision that supported an engineering alliance with nature, predicated on scientific understandings, that promised new levels of state "command" over the land. This was, as most engineers realized, a framework—unlike the law—in which irrigator "custom," whatever its occasional intrusion into engineering practice, had no *formal* place at all.

The Indus Basin as an Integrated Water Environment

The most powerful exposition of these principles occurred in the mobilization of a macro-level vision of the Indus basin as an integrated river basin environment composed of multiple parts. This did not mean, of course, that every canal required the same structure of administration, for water control in the region continued to show a high degree of diversity in different jurisdictions. Nor was the entire river basin by any means incorporated into this vision. But the logic of irrigation management in the canal colonies suggested that, at the cutting edge of professional science, all irrigation systems on the plains had now to be considered, to some degree at least, as part of an interrelated, technical whole. This was brought most clearly into focus in notes submitted to the Indian Irrigation Commission of 1901–3, which was appointed to review Indian irrigation policy, in part in response to the specter of famine in many parts of India, and in part in response to the new possibilities for irrigation raised by the Chenab colony's success.[41]

The need to see all irrigation in light of the larger interconnections of the hydraulic environment was suggested most clearly in a note to the Irrigation Commission written by Jacob. In the wake of experience in the Chenab colony, he sharply criticized the narrowness of earlier irrigation planning. "Hitherto," Jacob wrote, "each scheme has been looked at independently as complete in itself." But the Chenab colony had shown the folly of this view. With vast wastelands in the Indus basin still available for transformation, water had to be moved, Jacob argued, from areas where it was in abundance to areas where it was in deficit, so that a maximum quantity of land could be brought under "command." The government had, in the past, often resisted such large projects for fear that water would be inadequate or "that the vested rights of old irrigators" would be disrupted. But for the future, he implied, the logic of the river basin (that is, of nature itself) had to be given precedence. Jacob laid down two principles, rooted in the engineering obsession with controlling waste, that defined the imperatives driving engineers to increasingly see the Indus basin as a technical whole: "(1) use, if possible, all the available water and do not let any be wasted; (2) spare no effort to irrigate every bit **(p.155)** of land which needs irrigation."[42] Only if these principles were realized, he implied, could the Indus waters be made to perform their optimum "work."

It was such a view that empowered the most audacious plan to come out of the deliberations of the Irrigation Commission, namely the suggestion that water should now be moved from river to river within the Indus basin in order to maximize its effective “command” of the region’s wastes. The success of the Chenab colony had vastly increased engineering confidence in the power of science to transform the environment by bringing water to wastelands. But the immediate problem facing irrigation engineers at the turn of the century was to find sources of water to irrigate the huge government wastes that remained in areas where water was scarce on the plains, particularly the Lower Bari Doab. Supplies in the Ravi, which could most readily command the Bari Doab, were inadequate to the needs. Only if water constraints were considered in terms of the Indus system as a whole, some engineers now realized, could the problem be effectively addressed from a technical viewpoint. It was Jacob and James Wilson (a prominent civil official) who first proposed the solution: simply move water from the western rivers (Jhelum and Chenab), where water was ample, to the eastern river (Ravi), where supplies were limited. This plan, which came to be known as the Triple Canal project, was endorsed by the Irrigation Commission and finally designed in 1905 by the Punjab chief engineer, Sir John Benton, a Cooper’s Hill graduate. Completed in 1915, it involved the construction of two huge link canals (Upper Jhelum and Upper Chenab) that moved water eastward from the Jhelum to the Chenab to the Ravi, so that enough water would be available in the Ravi to fill the Lower Bari Doab canal and open the wastes of the Lower Bari Doab to agricultural colonization. It thus dramatized in practice what Jacob had underscored in his memo to the Irrigation Commission—namely, that the effective use of water to irrigate a maximum quantity of land required a view of the Indus rivers as part of a single water system (see map 7).[43]

The Triple Canal project defined the emergence of a new era in Indus basin irrigation. Only when the waters of the Indus basin system were seen as a single integrated hydraulic system, in which water could be moved from one river to another, was it possible to make effective “use” of all available water to irrigation all available wastelands. The project signaled a vision of environmental control on a macro level that mirrored the forms of local control rooted in the modeling of flow to each irrigation chak. Though it hardly allowed for complete management of flow (which varied markedly from season to season, continuing to bring serious flooding in the summer season), it had made clear that the marshalling of scarce water supplies and their careful distribution between separate canal “commands” was now critical for maximizing the “wastes” opened to agriculture. The superintending engineers of the five “linked canals,” as they were now called (Upper Jhelum, Lower Jhelum, Upper Chenab, Lower Chenab, and Lower Bari Doab), which **(p.156)** watered the major canal colonies of the Punjab, met annually after 1915 to discuss forecasts of needs and supplies and to try to match water availability to water needs, moving water from one river to another (often by rotational openings and closures of canals) as requirements dictated. As a metaphorical “engine,” the irrigation system had thus increasingly become an integrated whole, defined by its many interrelated parts.[44]

Indeed, once such a conception was in place, even older systems of irrigation, such as Punjab’s inundation canals, came to be subjected to new forms of systemic evaluation. With the opening and expansion of the canal colonies at the turn of the century, local officials had increasingly been forced to take cognizance of the interconnections that existed even between inundation canals and the larger perennial canal system. Large-scale canal colony water withdrawals inevitably influenced downstream irrigation, particularly the critical opening and closing dates of inundation canals in the spring and fall, when adequate water was often critical to successful cropping. Debate thus focused on the degree to which rivers were recharged by canal colony irrigation water draining back into the river system, an issue open to conflicting interpretations

of (still limited) flow measurements.[45] This also defined new interconnections between irrigation in Punjab and in Sind, as we shall see in the next chapter. But the pressures on inundation canal management suggested how even “minor canals” were swept into this systemic river basin vision.

Wastelands, Canals, and State Power

Such a sweeping, unifying, technical, and environmental definition of the Indus basin carried, of course, its own political implications. Engineering doctrine held out the prospect of a new vision of “community” and of the “common good.” This was shaped by a new vision of nature—and a new sense of common interest, transcending individual property interests—that linked experts and irrigators alike within a vision of the “natural” environment. However partial the relationship of this vision to the ongoing realities of the Indus basin, the vast expansion and success of the canal colonies had, by the turn of the century, begun to give this vision a real purchase in the minds of many British administrators.

The political implications of this new engineering vision of the Indus basin cannot be fully understood except in terms of the intersecting scientific and revenue meanings of a key term in this vision: the word “waste.” Indeed, this engineering vision of controlling “waste” must be juxtaposed against the different meaning of “waste” that had already been inscribed by the property system on the vast stretches of state-owned “wastelands” that the canal colonies came to occupy. “Wastelands” were, under any definition, considered ripe for the operation of science, for they were, by definition, lands waiting to be put to “use.” But “waste” also had another—and **(p.157)** in some ways equally important—structural meaning within the colonial property order. The concept was a key to the marking—and ordering—of distinctive forms of property and community on the land. The association of the village “community” with “waste” (through the commons) and of government power with “waste” (through its direct claims on all nonproductive, nonrevenue-paying land) were central features of the political system and of the ways that the colonial state had sought to stabilize its authority on the land. This is why, at least within the structural framework of British power in the Punjab, the meanings of the canal colonies were ambivalent. On the one hand, irrigation and settlement on the “waste” represented a vast accession of power and revenue for the state, as these lands were made “productive.” On the other hand, the transformation of the “waste” on such a scale threatened to undercut another, critical vision of state legitimation that was powerfully linked to the structure of landed property. This was a vision rooted in the state’s self-definition as a public entity, standing above and apart from the separate worlds of local “community” and production alike, and regulating both through law and through the legal differentiation of productive, revenue-paying land and “waste” on the ground.

Engineering and State Wastelands

This tension can be tracked in the history of British attitudes toward “wastelands” that led up to the launching of canal colonies and that shaped their subsequent development. The history of state control over wastelands in the Indus basin was, as we have seen, a complex one. State control over considerable quantities of wastelands had long been an important feature of the colonial property system, which was reflected in the important meanings attached to “wasteland” in the Punjab’s property settlements. In extensive arid tracts, such as in the *bar* lands of western Punjab’s doabs, state-controlled wastelands were extensive, representing, essentially, that which was left over after wastes were assigned to villages at settlement, and it was on these lands, in the era before the canal colonies, that the government had often given individual leases, convertible to individual property contingent on individuals sinking wells or (in

the case of water lords) building canals in order to make them productive.[46] Some state rakhs were also set aside in Punjab for other nonagricultural purposes, such as fuel or forest reserves.

However, as an alliance of state and science developed increasing significance in the last decades of the nineteenth and early twentieth centuries, such "wastelands" had begun to take on new meanings for state officials. Changes in government attitudes toward "waste" can be tracked through shifting government policies beginning in the 1880s. By that time, state wastes were scarce in much of central and eastern Punjab, where agriculture had expanded considerably from the time of annexation, and this alone led the government to become more protective of state rakhs, sometimes for specific "developmental" needs, such as timber **(p.158)** or other resources for railway development. Many rakhs were assigned to the Forest Department.[47] But in western Punjab, where arid state wastes were far more extensive, shifts in state wasteland policies followed a different trajectory, though one equally dramatic. By the early 1880s, there were over 12,000 square miles of *bar* land on the Punjab plains that were in government rakhs (used largely for grazing), of which about 15 percent were controlled by the Forest Department.[48] In spite of the quantity of these lands, however, officials after 1880 became increasingly wary of leasing such lands to individuals, even when they promised to sink wells or build small canals. The fact that this would lead to the establishment of proprietary rights now appeared to many officials to be precisely the problem. Control of such lands was, in a sense, a marker of state power. But, more important, the state increasingly saw the developmental potential of such lands, increasingly seen to hinge on state knowledge, as threatened by the spread of private interests.

British policy toward "wastelands" thus showed a critical shift, and one that was closely associated with the rise of professional, state-based engineering. Rather than seeking to disperse wastes to villages and individuals—and thus to extend the colonial property order—the state sought increasingly to protect and engross wastes in order to make possible the direct operation of science on the land. Lt.-Col. E. G. Wace, the Punjab financial commissioner, put it succinctly in 1888: "[W]e have to deal with an entirely different state of affairs to that on which the old leasing system was founded. It is [now] the Government, and not the lessee, that makes agriculture possible by the construction of a canal at an outlay and with skill entirely beyond the means of the agriculturist."[49] In some cases, the state even moved in these years to take back wastelands previously assigned to village communities, in order to make them available for state action (and eventual agricultural colonization), a trend that became increasingly marked as canal colony expansion progressed. The most dramatic example of this occurred in the case of the Sind Sagar doab, west of the Jhelum and Chenab rivers, where large areas of waste had previously been assigned to village commons. This had been done in earlier land settlements precisely to facilitate the incorporation of pastoralists into the territorial structure of village boundaries. But the British now introduced legislation to make the state reassumption of these wastes possible. As Wilson wrote in 1900, "[I]t should be borne in mind that our object is to obtain, over as large an area as possible, an absolute right to grant what land we choose to colonists from a distance, without any interference from persons who have hitherto held or claimed any rights over it."[50] Wastes thus assumed significance for their role not in the delineation and extension of the colonial property order but in the new exercise of direct state authority on the land.

This shift was clear in the canal colonies, where new peasant settlers were given leased land that was initially loaded with state conditions, as even with settlement **(p.159)** the state continued to assert its ownership of these "wastes." "Peasant grantees were to remain as

occupancy tenants," Imran Ali writes, "and were not allowed to acquire proprietary rights."[51] In name, of course, the "village estate" remained the key framework for settlement in these colonies, but its technical meaning was transformed as it became synonymous in the canal colonies with an irrigation chak carved out of crown land. The technical structure of water delivery, engineered by the state, thus became the primary foundation for demarcating new mauzas. For this, the Sidhnai provided the ground on which British settlement policies were first delineated, whatever problems ultimately developed there with agricultural settlement. "What I wish to urge," wrote Wace in summing up the initial plan for grants of land and for the establishment of villages on the Sidhnai, "is the very great importance of insisting that the several grants shall be demarcated with primary regard to the irrigating system on which they will depend for the success of their cultivation."[52] In carving the boundaries of each new mauza from the waste, the British made no pretense of relating such boundaries to "old associations," or community territories. Rather, the key to the demarcation of each village was the area to be "commanded" by each minor distributary of the canal (an area of about 2,500 acres), which would allow every village estate to be defined ideally by its own distributary minor. Within each village estate, the land was then surveyed into squares, which were the foundation for individual leases and for the alignment of most watercourse channels within the village. The state's direct control over the waste—and its control of hydraulic engineering science—thus framed its controlling power over a newly settled peasant society. Indeed, with the structure of settlement defined not simply (or even primarily) by colonial property law but by the new irrigation system's "command" of the land, the developmental authority of the state was cast on new foundations.

Such structures were further elaborated in the Chenab colony and on later canals. In organizing colonization on the Chenab canal, Frank Popham Young decided to depart from the Sidhnai model in laying down in advance of the construction of irrigation minors a single grid of surveyed squares that encompassed the entire colony. It was the definition of the land as state waste, of course, that allowed the state to do this, ignoring all preexisting property claims. But Popham Young sought to link the structure of agricultural holdings even more tightly than in the Sidhnai to the engineering structure of irrigation. Beginning with the demarcation of squares for individual grants (each comprising in the Chenab colony approximately 28 acres, as opposed to 22.5 acre squares on the Sidhnai), he laid out also a grid of small squares (*killas*, one twenty-fifth of a large square, or just over 1.1 acres in size), each intended to constitute a "field," or cultivating unit. Incorporated into village estates (or, in this case, chaks) that were demarcated on the basis of areas commanded by minor distributaries, "the next and most important step," Young wrote, "was to induce the *zamindar* to permanently demarcate **(p.160)** the fields thus laid out by throwing up ridges or banks of earth [*kiaris*] on two sides of the small square, and by digging small distributary water-courses on the two other sides."[53] This was possible, of course, only on fully level ground. But to the extent that this was accomplished, the principle originally articulated during the colonization of the Sidhnai was extended, namely that "colonists must not be allowed to carve out for themselves amorphous polygonal holdings to suit their own whims, but that villages and grants must conform regularly to irrigation limits."[54] From the demarcation of village boundaries to those of individual cultivating units, the aim was to encompass the system of cultivation within a frame of technical and environmental management defined by a scientific, irrigational structure.

The Irrigators and the Hydraulic System

In certain ways, much in the new relationship between state and society that began to emerge in the canal colonies was prefigured by the Canal Act of 1873. It was that act, after all, which had legally defined the authority of state-employed engineers to manage state-controlled canal systems in the name of efficiency. In its establishment of a contractual nexus between the state as the legal owner of all surface water and the individual water user, the act had also defined, at least in theory, the image of a large community of water users with common interests defined by their common productive dependence on water supplied by the state.

Yet the Canal Act had also been linked to a vision of agricultural expansion and development that was deeply embedded in an older colonial property order. The authors of the act had conceptualized water as being delivered by the state to property owners—that is, to men with both statutory and customary rights defined by their ownership of land. These property owners, as British officials conceptualized them, were embedded in communities defined not just by the relationship of individual producers to state-run canals—or to a larger hydraulic environment—but by the structures of law, custom, and common lands. The "village" had been typically defined in central Punjab as the nexus between property and "tribal" genealogy. It was a space rooted not just in a physical environment but in an environment of blood. It was the manipulation of this concept of the village—along with the expansion of the colonial regime of property—that had thus defined the moral foundations of the state's earlier vision of expanding settlement and "development."

Although the village also assumed a critical place in the canal colonies, the very structure of settlement in the Chenab colony defined a legal framework for colony villages—and for "development"—that was strikingly different from this earlier vision. Peasants were settled not as property owners but as long-term lessees on government wastelands, and, as a corollary, there were no separate wastes to be attached to proprietary village communities as share-based common lands. Squares of unallotted wastelands (*charagah*) were attached to colony villages for **(p.161)** grazing, but these, like village watercourses, were not community property; they were owned by the state.[55] But nothing, perhaps, signaled the new environmental framing of colony villages more clearly than the practice of naming them by assigning them numbers based on their position within the branching structure of distributaries defining the irrigation system of the Chenab canal. The contrast with villages in central Punjab, where names more frequently reflected the ancestry or tribal genealogy of the villagers, could not have been more striking. Not all colonists used the system of numbers; they sometimes called colony villages after the home villages from which the largest number of settlers came. But as the *Chenab Colony Gazetteer* noted in 1904, most settlers used these numerical designations in dealing with the government.[56] Even in the 1920s, as Malcolm Darling reported, the use of numbers for colony villages remained the rule. "Every village in the colonies has a number instead of a name," he wrote.[57]

This contrast alone suggested the potentially new foundations of village community that state-sponsored settlement in the canal colonies opened out. Many officials saw the new form of the colony village as the space within which the individual villager could be remade to fit into a new kind of community—one defined less by its place in a world of blood and ancestry and more by its place in a larger state-engineered environmental structure. The key to this was the organization of space. As the basic success of the colony framework became clear, officials devoted considerable attention to village site plans that would mimic the regularity of agricultural allotments and the irrigation system so as to encourage discipline and a less

parochial, genealogical mind-set among the villagers. Village sites (*abadis*) were increasingly laid out according to fixed plans. They were generally defined by broad central crossroads whose intersection, as B. H. Dobson put it, was to be "the pivot of village life, where the shops, well and public buildings are assembled." Settlers were required, in the words of the *Colony Manual*, "to build their compound walls on fixed alignments so as to ensure regular streets."[58] All of this was intended to encourage a simultaneously more ordered and more open public life, where the villagers themselves would be transformed in part through coercive rules (like those intended to produce efficient irrigation practices in the fields) and in part through new structures of space that would allow them to see their relationship to the larger environment beyond the village in new ways—and to become in the process willing accomplices in the state's new environmental and spatial project.[59]

Incorporation of colonists into a larger system thus required, ideally, a mix of authoritative regulation and the encouragement of new spatial practices. This can perhaps best be seen in the new emphasis in colony villages on reforms in what the British called "sanitation"—a term redolent for the British of more cosmopolitan (and middle class) attitudes and of incorporation into a mind-set geared toward controlling nature's "waste" and disorder. This referred not just to matters relating to drainage and public health but also, more broadly, to the cleanliness and order **(p.162)** of the village site. Attention to sanitation was mandated in part through rules, failure to adhere to which made villagers subject to fines. But this was linked also to emphasis on new spatial practices that were intended to transform everyday village attitudes. As Dobson put it:

> A vigorous effort has been made by persuasion and exhortation to banish noxious elements from the sphere of human habitation. Thus tanks are now frequently transferred at the request of *lambardars* beyond the pale of the boundary road: special areas are provided in the adjoining *charagah* for manure, which no longer fouls the dwelling sites: and grantees are encouraged to follow the admirable example set by Janglis and stall their cattle in steadings away from the *abadi* on cultivated land.[60]

Model villages were erected on colony extensions where "educated" colonists, who were expected to devote maximum attention to "sanitation and general village improvement," were settled to serve as "an example to the colony" as a whole.[61] Rewards, including *khilats* (ceremonial robes), were given to the headmen of exemplary villages.[62] Although villagers sometimes protested the coercion inherent in some government rules, the idea was to transform villagers into men who were more accepting of science and discipline (including self-discipline) and ready to take their place in a new system.[63] An internal transformation of the self would follow the external transformation of the colony space in which the individual was embedded.

Critical to this, of course, was also the new interdependence that the colonies generated between village and city. Planned market towns and rail lines were envisaged by colony planners to be just as important to the larger structure of the canal colonies as new irrigation works themselves, for they provided the central focal points for the commercial export of the colony surplus.[64] Towns were thus an essential part of the colonies' larger environmental vision. Indeed, colony planners sought to turn new towns like Lyallpur, the central mart and rail link of the Chenab colony, into nodes of dissemination to villagers of both commercial and agricultural knowledge. With the establishment of an Agricultural College at Lyallpur, for example, the town became, as Darling later put it, the "main center of agricultural development" in the colonies, attempting to disseminate improved practices to the rural areas.[65] Beyond this, the city's

physical structure and organization of space dramatized the new linkages between city and village that would distinguish the colonies from central Punjab. Popham Young designed the center of Lyallpur in the form of a large square, laid out on four surveyed colony squares, with eight bazaars radiating in regular patterns from a central chauk (crossroads).[66] These bazaars, which were largely agricultural markets, were conceptualized much in the same way as the new village abadis, though on a larger scale, as symbols of order and organized community life. Perhaps most telling, a clock tower, a symbol of ordered regularity, stood at the very center of Lyallpur's plan, built in the first decade **(p.163)** of the twentieth century with the subscriptions, as the *Gazetteer* put it, of "the colonists of the Bar as a Memorial to the late Queen-Empress."[67] Far more than in the rest of the Punjab, village and city were intended to become in the canal colonies conceptually interlocking parts of a common world.

The potential effects of the spatial order of the new colony towns was suggested by the comments of Prakash Tandon, whose father was a Roorkee graduate and whose family moved in the early twentieth century from the old city of Gujrat to the new colony town of Sargodha, the chief market of the new Jhelum colony. Sargodha, Tandon wrote, was "planned, well laid out and had plenty or light and air. Its streets and lanes were wide and straight." But the contrast with Gujrat was social as much as physical. "Somehow," Tandon noted, "the clean, hygenic, impersonal layout seemed to mould the population into the pattern the settlement officer of the late Victorian period must have had in mind. There was more social and political awakening in Sargodha; its municipal affairs were better run; its communities had started new schools. The singing and dancing girls were moved out of the city, first near the canal bank and then still further away."[68] Controlling disorder—moving dancing girls out of the city just as one sought to shift manure piles out of the village abadi—was the key to creating new kinds of men to fit into a larger system of bringing order to nature. Indeed, the image of moral order and cleanliness suggested by Tandon's vision of Sargodha was the same image that many colonization officers had in mind for the canal colony villages whose produce filled Sargodha's markets.

The Canal Colonies and the Village

Yet, for all the emphasis on such social transformation, the older vision of the village as defined by genealogy was hardly abandoned. British policy with respect to the role of the village in canal colony settlement suggested the deep ambivalence surrounding the canal colonies' political implications. The vision of the colonies as a transformative space, defining a commonality of community between the state and the irrigators, was a powerful one. And yet the attachment of the British to the village community as a stabilizing "natural" frame of political ordering remained a powerful force, as well.

This was a view of the village not just as a physical space that could be managed for purposes of social transformation but also as a legal space with deep roots in colonial law and policy. It was an image defined by a different "natural" environment: the environment of blood. Even men such as Popham Young, who were deeply committed to the idea of the colonies as a transformative physical environment, held firmly to a deeply ingrained vision of the Punjabi village as an entity defined fundamentally by the ties of custom and genealogy shaped not only by history but also (as we have seen in earlier chapters) by long traditions of government policy. Within this frame, the very word "villager" carried meanings in tension **(p.164)** with the image of a new colony man. As a "villager," the colonist was embedded not in a transformative community of environmental transformation mobilized by engineering science but in a local community defined by the inescapable power of blood.

It is hardly surprising in this context that the actual processes of canal colony settlement were marked by sharp social and political contradictions. From the very beginning, colonization policy had shied away from any notion that a stable rural society could be constructed in the colonies simply by encouraging the migration and resettlement of individuals in new colony spaces (however central the productive individual was to the discourse of social transformation). On the stabilizing importance of preexisting "village communities," most British officials were quite clear. As the lieutenant-governor, Sir Charles Aitchison, observed in 1885 with respect to the Sidhnai, without such local communities, defined in law by ancestry and patriarchy, rural stability could not be easily achieved. "A manly peasantry," he wrote, echoing the standard British patriarchal view of the village, depended on the settling of colonists "under leaders of their own in complete village communities of cultivating yeoman lessees, who will gradually grow into proprietors."[69] The importance of this became all the clearer with the subsequent settling of the Chenab colony. In a telling admission, the government had at the very beginning made clear that the process of Chenab colony settlement was to be in keeping with "the tradition of the Punjab as a country of peasant farmers. No other general frame of society," it declared, "is at present either possible or desirable."[70] And what made a "peasant," of course, was his embedding in a particular sort of genealogically based village community. In settling men in communities modeled on those of the central Punjab, the British tried to maintain a framework that many saw as critical to the stability of their rule.[71]

Whatever the implications of the manipulation of colony space, village space thus came to the colonies already loaded with meanings. As Dobson wrote in 1915 in summing up Chenab colonization, the importation of settlers from central Punjab had been "coupled with a determination to introduce only practiced agriculturists of approved antecedents and to found, in so far as might be, none but healthy rural communities of the best type."[72] "Healthy rural communities," was, of course, a phrase that could be interpreted in multiple ways by different officials. For some, these were communities defined by new models of order and regularity, linked to the larger hydraulic system. But the phrase "approved antecedents" suggested another underlying vision. For Dobson, as for many others, even agricultural skill, perseverance, and efficiency—key attributes in adaptation to the new colony environment—were, for most colony migrants, heavily dependent on inherited "tribal" characteristics. Sikh Jats (or "Hindu" Jats, as they were commonly called at the time) and Arains were thought to be the best cultivators, based on deeply held British assumptions about the power of blood in shaping agricultural **(p. 165)** aptitudes and attitudes. As Dobson summed up the situation in his final settlement report on the Chenab colony: "The tribal composition of the body of grantees in an assessment circle is a matter of the first importance in estimating its capacity to pay revenue: there are variations in soil and inequalities in water-supply, but the strength or weakness of a circle ultimately depends on the agricultural character of those who hold the land."[73]

As Dobson's language suggests, religion was an important element in such calculations as well, as it also shaped "healthy rural communities" and their connections to agriculture and the land. Most colony villages had their own "mosque[s] or dharmsala[s]."[74] But in the context of colony settlement, officials generally saw religion as in no way separate from the local genealogical community that lay at the heart of the British property order. Though religion had the *potential* to provide a framework for cultural change (indeed to become a vehicle for the individualizing cultural and moral transformations that some saw as inherent in the new ordering of nature marking colony space), this was not how most British officials looked at the role of religion in the colony context.[75] It was part and parcel of ancestral community. Even as they held out a vision of

the culturally transformative power of the colony environment, most officials saw religion and local tribal organization as mutually reinforcing and closely intertwined.

British efforts to adapt the village to a new structure of environmentally based power and community thus reflected ultimately the deep contradictions in their own thinking—and, on the ground, these contradictions took many forms. One dramatic example was in the relations between colonists and village "menials," or kamins. In some respects, the structure of the colonies promised to transform the relationship between landholders and subordinate classes. Contrasts with central Punjab were in some ways striking. In central Punjab, the legal subordination of kamins to "village proprietors" was one of the most clear-cut markers of the colonial legal conception of the village community. The kamins' exclusion from and subordination to the village proprietary body was marked in much of the Punjab by their lack of shares in the village commons. In the colonies, however, there were no village commons in the usual administrative sense. State control of the land, and of the common grazing square (or charagah) meant that there was no sharp legal line of demarcation between proprietors and kamins inscribed on the land through shares in the commons. In fact, in the interest of attracting kamins to new colony villages, the British decided early on to set aside one or two squares of (state-owned) land in each Chenab colony village to be opened for cultivation by kamins.[76] The economics of the new colonies, where kamins were in high demand, suggested the potential for a more open relationship between kamins and settlers within the new environmental framework of the canal colonies.[77] This was an arena in which the colonies opened up possibilities for significant social change.

Yet, in direct counterpoint to this, the British took a number of steps—both spatial and legal—to reinscribe central Punjabi notions of the subordination of **(p.166)** kamins to the village "proprietary body" onto the canal colony village. Initially, no special arrangements were made in colony sites for the controlled residential settling of kamins. But, in the name of order, this was soon changed. As Dobson noted, "[W]ithout some organized scheme of allotment, these persons would have swarmed promiscuously round every abadi, reproducing the squalour and congestion of the old homes, which it was the ambition of the Colony officers to avoid." Here was language redolent of the British concern for open, sanitary villages. But the "remedy" for this was not a plan that assimilated kamins to ordered colony space in the same way it did ordinary colonists but one that underscored spatially their social subordination to the colonists who received land allotments. New site plans in the 1890s included "separate quarters" for menials at the edge of the village abadi. Subsequently, British concern for the spatial separation of kamins intensified; "menials," as Dobson later argued should be "completely isolated and provided with tanks and *chauks* of their own."[78] The point of this was not simply to underscore the subordination of kamins but to reinscribe the distinctions of tribe, caste, and ancestry that defined the village "proprietary body" even onto leased colony lands. Kamins were thus given access to cultivation on special village squares, not through an open land market but rather at the sufferance of the collective body of village allottees, even as they were rigidly excluded from receiving (or purchasing) regular allotments of colony land themselves.[79] The result, as Ali puts it, was that "physical representations of the hierarchical ordering of society were impressed upon the subaltern classes as comprehensively in the canal colonies as they had been in former habitations."[80] Perhaps most noteworthy, the distinction between land allottees and kamins, though in fact preeminently one of class and occupation, was reproduced in the colonies not as part of a new class-based social order but as one largely defined and discussed, like village community elsewhere, in the language of tribe, caste, rights, and blood.

Similar considerations operated in the realm of landed inheritance, where assumptions of patriarchy underlay all visions of social transformation. In the early years of settlement, many colonization officers assumed that colony settlement would require some critical modifications in Punjabi customary law, particularly as it related to "tribal" patterns of landed inheritance. Protection of colony allotments from fragmentation was critical to the larger patterns of colony development, and colonization officers generally saw this as requiring careful oversight of patterns of inheritance on colony leases. Concerns about land fragmentation even led in some cases to the approval by colony officers of the passage of leased land (in violation of common patterns of customary law) to unmarried daughters. But such concerns soon came into conflict with the ongoing political interest of many officials in using law and genealogy to stabilize colony villages and assimilate them to larger patterns of village organization found elsewhere in the Punjab. Nowhere was this clearer than in the administrative decision to order the preparation **(p.167)** of "records of rights" in village administration papers (wajib-ul-arz) in the newly settled colonies (including the important genealogical tables), just as they were elsewhere in the Punjab. Some officials, of course, balked at this decision, questioning what "ancestral" customs and rights there might be in newly settled colony villages. But such questions were quickly answered by those who urged that customary practice should simply be determined by the "ancestral" practice of the villages that colonists originally came from, supplemented by the emergence of new customs.[81] As such records were drawn up, most colony villages were thus assimilated, in spite of occasional court challenges, to the inheritance practices shaped by the "customary law" of the Punjab. As the Colonies Committee later noted: "Since about 1899," it had been "the practice in the Chenab Colony to grant mutations [in matters of inheritance] in accordance with the customary law of the parties concerned, reference in all cases of doubt being made to the districts of origin."[82]

Customary law was built, of course, on the fundamental assumption that social organization based on "tribal" genealogy defined the patriarchal essence of the Punjabi villager, or peasant, as a particular type of man. The village defined legally by "custom" was a morally gendered, genealogical entity, shaped by a natural environment of blood and kinship. Once again, as in the case of kamins, this suggested the deep tensions in colony policy. In the case of women, too, there is much to suggest that the new environmental structuring of the colonies opened up new possibilities for social transformation. Although changes in the roles of women precipitated by new forms of colony agriculture have been little studied, some research suggests that shifts toward highly commercialized, irrigated agricultural production tended generally to create new divisions of family labor and new opportunities for women, and it is likely that this was the case in the Chenab colony.[83] Nor can one discount the implications of new structures of colony space in defining new public roles for women. But for many British officials, the transfer of customary law to the colonies presupposed the continuing social power of patriarchy as an inescapable attribute of the very meaning of being a "peasant" or "villager." As much as any other policy instituted by the British, the continuing reliance on customary law thus suggested the deep-seated contradictions in British efforts to incorporate the village into a new vision of the Indus basin as an engineered hydraulic environment while maintaining a patriarchal image of the "village," linked closely to the structure of British law and British rule.

Visions of Environment, Visions of Community

The reality faced by new settlers in the colonies was thus complex and conflicted. Many responded readily to the opportunities the colonies offered for commercial **(p.168)** production and higher incomes. They participated in an agricultural system that became, as M. Mufakharul Islam has put it, "one of the most market-oriented in the whole of Asia."[84] To this extent, many

colonists were fully willing to become partners with engineers, as one Sikh author said, in "man's conquest over nature."[85] For his part, Darling wrote admiringly of colony migrants in 1920s, describing in detail one village (Chak 208) that he took to be typical. "Good seed is obtained from the farm in Lyallpur, and a large number of modern implements are in use. … All through the village there is an atmosphere of development." Indeed, "In less than a generation," Darling wrote, the Jat Sikh had made "the wilderness blossom like a rose."[86] In such views, the colonists had taken their places alongside engineers in a community defined by the conquest of nature.

Yet, however much the new regularities of the British hydraulic system—and of the spatial order of the colonies—may have drawn irrigators into new and broader visions of environment and community, they also subjected them, in a far more immediate sense, to new and often increasingly intrusive forms of state control. Many met these new forms of state intrusion with suspicion and resistance. Engineers, of course, justified this intrusion not only in the name of science but also in the "interests of the whole community," a community now defined by the dictates of efficiency and equity within a large and interdependent hydraulic environment. But, though many irrigators may have benefited from these policies, they also experienced the realities of new British policies in quite contradictory terms. If the British defined new horizons in the control of nature—and therefore productivity—their policies also often limited in many critical ways the direct local control of irrigators over the productive environments of which they were most immediately a part. This was, arguably, linked to the persistence of a special vision of state authority tied to control of the "waste," even as colony "wastelands" were now being productively transformed.

It was little surprise in these circumstances that, even while adapting readily in many ways to British spatial structures and irrigation reforms, many people in the new canal colonies sought levers to resist new developmental pressures. Most important for understanding the future of the canal colonies is understanding the terms in which such resistance frequently developed—that is, in the language of popular "rights" and ancestral "customs," often powerfully linked to notions of "ancestral" or "village community." Given this language, some British officials tended to cast irrigator resistance to increasing state pressures in the canal colonies as evidence of continuing peasant conservatism and backwardness, thus putting colony officers squarely on the side of "modernity" and villagers on the side of what the British called "tradition." "Disaffection," as one official put it, "was but the price of efficiency: in creating, or attempting to create, ideal conditions the Colony officers found themselves at variance with public opinion, which expressed itself emphatically in favour of ancestral custom."[87] But appeals to "ancestral custom" **(p.169)** were hardly a product just of (or even primarily of) peasant conservatism; they were also an invocation of the moral principles that had long helped to legitimize British law and administration—and thus a frame for "peasant" empowerment within the ideological structure of the colonial regime itself. It was, after all, the British themselves who had insinuated these principles into canal colony settlement policies in myriad ways. In this sense, appeals to "ancestral rights" allowed colonists to play on the contradictions—and the opposing frames for appeals to community—shaping colonial modernity itself.

Indeed, irrigators sought to maximize their leverage by setting one moral appeal to nature against another, with the natural "rights" derived from the logic of blood and local community (which the state itself had of course long since recognized) set against the moral logic of efficiency derived from the large-scale modeling of nature's productive powers for the control of "waste" and for the "common good" of the community at large. As E. P. Thompson's evocation of

a “moral economy” among the poor in eighteenth-century England has shown, popular resistance to new state pressures was most powerful when it turned the state’s own, protective moral language to its own purposes, playing on the fissures in the state’s languages of legitimation.[88] This was now clearly the case in the Punjab.

Irrigator resistance to the state was thus intimately tied to contradictions within the legitimizing ideology of the state itself, which played themselves out in debates over irrigation policy within the government in the first decades of the twentieth century. In some ways, these can be traced back to the same tensions between statute and custom that shaped irrigation policy in the wake of the 1873 Canal Act. But they gained new meaning and urgency with the rise of the new hydraulic and environmental visions heralded by the opening of the canal colonies. Though these conflicts found their most pointed expression in the canal colonies, they echoed all across the Punjab in these years—from the old inundation canals of southwestern Punjab, to the Bari Doab canal in central Punjab, to the canal colonies themselves. They made manifest, for officials and irrigators alike, the larger moral conflicts faced by the colonial state as it sought to define political foundations for a new developmental alliance between state and engineer.

Some of these issues crystallized most clearly on old inundation canals. This period was one of considerable stress in seasonal canal management as new pressures for “efficiency,” arising from visions of the river basin as a whole, collided with older forms of control. New engineering imperatives were a factor in the abolition of the chher system of unpaid canal labor in the early twentieth century, however deeply this issue was embedded in far older debates about “custom” and statute labor on canals. But broader reforms on these canals led to a wave of irrigator petitions in the first decade of the twentieth century, complaining not only about limitations in water supply consequent on chakbandi operations and the **(p.170)** reduction of outlets (for reasons of efficiency) but also about the loss of local control by “leading irrigators” and local canal panchayats over water distribution and canal management following the chher system’s abolition.[89]

For engineers, these reforms were linked to the same larger imperatives that drove the canal colonies—that is, the need to subject these canals to new forms of engineering management in the interests of linking them into the larger Indus basin water system. But many irrigator petitions tended to focus precisely on their own loss of control (and on the loss of local knowledge) intrinsic to the very processes of assimilation that engineers stressed. As the Multan deputy commissioner put it, the zamindar “objects to be linked up on a large system as under this he is entirely at the mercy of the department officials, he can do nothing to supplement a bad supply, nor has he information in time to adjust his cultivation to the supply of water available.” This was echoed by another Muzaffargarh official: “The zamindars have been accustomed in the past to have a considerable say in the methods of irrigation and thus strongly dislike being deprived of this by amalgamation of large canals and closures of small ones about which they have not been consulted.”[90]

What gave these complaints importance was that they were picked up by many civil officials and pressed in internal administrative debates, about which irrigators were apparently well aware.[91] While differences between engineers and revenue officials focused on many technical aspects of irrigation management, the larger moral tension between “custom” and “efficiency,” and between conflicting conceptions of state relationships with the environment and community, ran underneath the debates as a critical subtext. Even as irrigators petitioned the Irrigation Department, some local officials thus wrote spirited defenses of the irrigators’ customary rights,

identifying past custom as a foundation for irrigator claims against the government within the irrigation system. In taking this position, some officials overtly cast themselves as *"amicus populi"* (friend of the people), suggesting the larger issues of moral legitimation that were involved.[92] "Of theory," the commissioner of Multan, W. R. H. Merk, observed, the people "know nothing." But far more important than scientific theory in the operation of inundation canals was a respect for existing customary rights. The people had had "rights" in irrigation "from time immemorial," Merk declared, and if these were taken away, then, at the very least, compensation had to be paid. In underscoring the moral and legal foundations of state recognition of customary rights, he thus challenged the power of a technical environmental vision to justify a complete reorientation in the longstanding foundations of the state's moral relations with the people (in which he, like many officials had, of course, an important stake). "The Irrigation Department has been and is acting as the London County Council would," the commissioner declared, "if it were to proceed now to lay out London afresh, after the plan of a city constructed in the prairies, and without concern for the rights and wishes of **(p.171)** the existing householders."[93] Nothing less than the consent of the people in their government was thus at stake.

Such challenges were of course met by many engineers with frustration and, in some cases, virtual incomprehension. That new forms of irrigation management precipitated some complaints was not a surprise, and many engineers were sympathetic to this. But the focus on custom and on rights as deriving from "time immemorial" reflected, in the view of many, a fundamental misunderstanding of the very nature of scientific water management, not just by irrigators but by many British officials themselves. Effective management required constant adaptation to changing conditions, not just to the developing "regime" of each channel but to the changing pressures of water supply in inundation canals as part of the larger Indus basin system. "The point that is so difficult for the man who has not made a speciality of irrigation engineering to understand," wrote one engineer, "is the constantly changing conditions with which we have to contend" and the concomitant need for ongoing technical adaptation to keep the larger irrigating "machine" in order.[94] To allow certain irrigators to continue to take more than their share of water, or to put stop-dams in channels to improve their supply—based on the claims of "ancient custom"—was, as they saw it, not just a challenge to existing statute (for such actions were clearly subject to government regulation under the terms of the Canal Act) but also a threat to the most basic principles on which they were building the irrigation system. As the chief engineer, W. B. Gordon, wrote, "no improvements are possible without some interference with existing conditions, interests and customs."[95] This was the lesson taught by a scientific understanding of nature.

Yet beyond even this, many engineers saw rationalization of canal management as itself rooted in moral principles no less compelling than the recognition of "custom." In the words of E. S. Bellasis, a Cooper's Hill graduate, the large owner had formerly "had control of his own and his neighbour's water. Now things are changed." To hold up custom as a principle in support of inefficiency and inequity was simply to preserve, he argued, an "old, corrupt and wasteful system" that, however popular, was "unrighteous in itself." Science, the structure of the larger natural environment, and utilitarian theory all dictated otherwise, pointing toward the primacy of the common good. Bellasis echoed Merk's London analogy in dramatizing the implications of official opposition to needed reforms. "What would be said if people, when municipal rules and such like are introduced anywhere, were encouraged to kick against them on the ground that their ancient customs are being interfered with?"[96] Progress would be impossible. The debate among officials thus drew irrigator complaints into a larger and more fundamental debate

among officials themselves on the legitimate power of the state to remake the environment, and nature, as a foundation for a new developmental order.

Such tensions were equally in evidence in controversies surrounding the remodeling of channels on the Bari Doab canal in central Punjab in the years just **(p.172)** before and after the turn of the century. Here village communities were far more important than in southwestern Punjab—indeed, this canal ran through a region that had provided many settlers for the Chenab colony. The place of village communities in irrigation management on the Bari Doab had drawn the attention of administrators from the canal's earliest days. But, once again, reforms intended to tighten up channel control (in the interests of extending irrigation and establishing greater systemic equity in distribution) provoked strong resistance based on a defense of customary rights. The need for periodic remodeling of canals had become central, according to the theory of canal "regimes," to established engineering doctrine. Remodeling normally required the reduction in size of the outlets serving villages near canal heads in order to allow more water to reach the tails as a canal's "regime" matured. Otherwise, engineers were forced to order the periodic closure of outlets (*tatils*) near the heads of canals in order to force the passage of water to the tail, a practice distasteful to engineers and many irrigators alike.[97]

However, villages near canal heads often bitterly resisted remodeling reductions on the grounds that, after long usage, this water was now their community's *haq abpashi*, or irrigating "right," a term that for many carried strong customary moral resonances (echoing the earlier efforts of the British themselves to record such *Haquq-i Abpashi* in varying contexts). As one Sikh landowner in Lahore district later put it: "[From] more than 70 years ago, we are using this water and it has become our right now," and, whatever the engineering justifications for reductions during canal remodeling, "it would be a great injustice if we are deprived of this right."[98]

Once again, of course, such claims gained force and significance precisely because they played into the debates among the British themselves—and because many British officials took very seriously the moral claims to resistance that they engendered. At the heart of this debate was the very meaning of *haq*, or "right," a word long used by the British administration but also one with old and deep roots in moral discourse, originally derived from Arabic. This was a word widely used in irrigation management, but for engineers it had a very specific, technical meaning, signifying the percentage of the commanded culturable land on an outlet that the Irrigation Department agreed to irrigate as it was planning new irrigation works. Scientific calculations of an outlet's "haq" were thus, as engineers saw it, highly contingent and based, in theory, on technical conditions within the village (or chak) and on the water available within the larger system.[99] In its very nature, as canal engineers saw it, the "haq" had thus to be modified in response to changes in a canal as it reached its "regime," and in light of the need to equitably deploy water along canals and among the system's commanded lands. For engineers, it was thus linked inescapably (at least in theory) to a concern for equity and efficiency among the (environmentally defined) community of irrigators as a whole.

(p.173) But the term also had deep roots in a very different administrative discourse that not only galvanized many officials but also seemed to legitimize the resistance to the increasing intrusion of state power that engineering reforms implied. Within this discourse, *haq* referred to rights determined by long usage and custom, which were rooted in the same principles of past practice and ancestry that structured the "village community" and customary law. Many British officials thus criticized engineering attempts at remodeling and outlet reduction on the Bari Doab from an early date, emphasizing the need for the protection of "vested rights," as some

officials put it, a key element in maintaining the stability—and moral political foundations—of British power. This led to the government's formulation in 1901 of what were known as "Haq Rules," which were intended as a compromise formula to allow rights to be protected even as remodeling went forward. But the working of these rules—and subsequent attempts to modify them—simply provided fuel for ongoing controversy and for an administrative debate that continued for decades. Some officials came to see the very word *haq* as a problem because of its multiple political resonances. As James Douie, the settlement commisssioner, wrote in 1906 in connection to water supply in the Chenab colony, "[I]t is a pity that the misleading word 'haqq' ever came into use." The efficient distribution of water was a "matter … in which it is essential that Government should have a perfectly free hand."[100] Yet disputes about water "rights" continued. To sidestep the problem, some engineers suggested replacing the word *haq* in official usage with the word *hissa* (or share), which was more contingent, reflecting the proportional relationship between the parts and the whole that was central to scientific thinking. But this word, too, was ultimately rejected on the grounds that its popular and administrative usages were no less deeply rooted in the language of village community (and "ancestral shares") than *haq*. Instead, the Punjab chief engineer directed simply in 1910 that engineers substitute the phrase "permissible area" for "haq" in official documents.[101] In spite of this, the word *haq* persisted in irrigator discussion of water supply long afterward as, in the words of one report, a "popular and erroneous designation."[102] This was, of course, precisely because it fit into an empowering rhetoric of resistance to increasing state control that invoked the state's own principles.

The Protests of 1907

All of this provided a backdrop to the significant movement of resistance to government policies that erupted in the Chenab colony in 1907. The movement was focused on more than simply water issues. Canal protests in 1907 were linked to broader challenges to British rule during this era, encompassing urban, Indian National Congress, and Arya Samaj protest against a range of British policies in the Punjab.[103] Nor were irrigation protests confined to the canal colonies. Indeed, among the most outspoken critics of British policy at this time were the very Bari Doab irrigators who had protested for many years against canal remodeling **(p.174)** policies and the concomitant interference with "rights." In 1907, these complaints were linked to protests over British proposals to rationalize water pricing on the Bari Doab by significantly raising water rates, which galvanized unprecedented levels of public criticism of the government. But the most serious protests, at least from the British perspective, were from the canal colonies, and they had focused on the passage in 1906 of a new Colonization Bill, which crystallized debate on the fundamental developmental principles on which the canal colonies were based.

At the heart of this Colonization Bill was the British concern to strengthen state control over processes of production in the Punjab and, in the process, to underscore the new model of state-controlled, environmentally based development of which the colonies were both the chief example and the chief symbol. The bill was prompted by government concern to neutralize a rash of legal cases that seemed to threaten the full exercise of state discipline over the colonies, particularly with respect to the government's ability to impose fines on cultivators to enforce residence requirements, rapid development of village homesites, nonwasteful usage of water, and "proper" village sanitation. These were matters of discipline central to the new developmental vision of the colonies and had always been assumed to be within the Colonization officer's prerogative. But in the face of several court challenges, the government had discovered after 1900 that it lacked statutory authority under the Colonization Act of 1893 to enforce such fines.[104] To make clear the critical role of executive authority in the colonies, the bill thus barred

the civil courts in the future from hearing such cases, thus underscoring a moral foundation for canal colony authority that transcended the old structure of colonial law. Beyond this, in order to prevent the fragmentation of holdings in the colony (which was critical to efficiencies of water usage), the bill limited the application of the regular law of inheritance (including customary law) on colony holdings more generally. The underlying assumptions behind the timing of the Colonization Bill were later summed up by Dobson with surprising bluntness: “The year 1906 mark[ed] an epoch in Colony administration,” he wrote. “By this time the purely beneficent stage was past: it had become necessary to enquire how far conditions of tenure had been complied with, especially the conditions as to residence; [as] pressure had been brought to bear on recalcitrants the work of colonization entered upon a phase as distasteful to the Colony officers, as it was vexatious to the people.”[105]

Yet the weaknesses in the government’s position were underscored by the protests the measure sparked. These derived primarily from two sources. First, the government’s position in asserting a new model of development linked to state environmental management was seriously compromised by the ongoing limitations in the colonies of the very structures of state environmental control on which new moral claims to government power theoretically rested. Far more than elsewhere **(p.175)** in the Indus basin, settlement in the colonies was entirely predicated on state control over an integrated technical system for delivering water.[106] If there was a common sense of community linking engineers and irrigators, it rested on this. And yet, much protest in 1907 focused precisely on the difficulties that the Irrigation Department still faced in effectively delivering adequate and timely water supplies to individual colony chaks as part of a larger hydraulic environment. Problems in effective deliveries to canal tails had been a problem from the very beginning. The years before 1907 had seen increasing attempts by engineers to tighten up distribution in the colonies by reducing supplies to some outlets (particularly near distributary heads) and more carefully controlling and regulating distribution to others, all of which was necessitated by the filling out of settlement on commanded lands in the colony. As the Colonies Committee later noted, in the early years of irrigation, with the soil still “hot” and holdings not properly broken up, large supplies of water had been necessary.[107] But with “regimes” and “duties” stabilizing, cutbacks in water delivery increasingly undermined irrigator confidence in the system. These problems were exacerbated by emerging problems of waterlogging and salinity, which forced the government to implement new supply rules in many areas that contravened earlier British commitments.[108] Opposition to the enforcement of government rules—and to the Colonization Bill—thus hinged in significant part on a growing lack of irrigator confidence in the government’s basic ability to deliver on its own technical environmental vision.

More important, such problems were compounded by the Irrigation Department’s ongoing reliance on a corrupt lower-level bureaucracy for the measurements and reports necessary for state action in effectively controlling supply. Reliance on lower-level officials exacerbated irrigator dissatisfaction with the irregularity of water supply, even as it increased irrigator resentment at the often arbitrary and corrupt levying of fines for violation of settlement rules and conditions. Irrigator complaints of favoritism and expense were thus common and increasing in volume in the years leading up to the Colonization Bill. Ironically, the state’s vision of technical and scientific environmental control seemed to depend, in the end, on local bureaucratic interactions that had little apparent relationship to the environmental and engineering principles that justified the tightening of state control and intervention under the Colonization bill.

Added to this, of course, was the seeming abandonment in the Colonization Bill of the discourse of “custom” and “rights” as a legitimizing foundation for the state’s authority. In barring the courts from jurisdiction and in seeking to limit the operation of customary inheritance in the colonies (all in the name of creating a more efficient system), the bill seemed to challenge the very levers that the British themselves had earlier recognized in negotiating with colonists. It was little wonder that, as Dobson noted, “it came as a rude shock to the majority to learn that Government proposed to apply with the full weight of official authority **(p.176)** regulations that now seemed to be an infringement of customary law and practice.”[109]

Not surprisingly, irrigators in the colonies, as elsewhere, fell back largely on the colonial discourse of “rights” to resist this proposed expansion of state control, accusing the state of having reneged on its own undertakings. The protests of 1907 were led by the editors of the recently founded *Zamindar* newspaper and by several prominent colonists who formed the Bar Zamindar Association to press the colonists’ grievances. Numerous mass meetings were held in the Chenab colony to protest the Colonization Bill, particularly along the Gugera branch where, as Gerald Barrier notes, “harsh residency and sanitary regulations as well as water scarcity had cut most deeply into the colonists’ faith in British intentions.”[110] Much of the rhetoric focused on government oppression (*zulum*), particularly on issues of rules and fines. Opposition to government was linked by some (such as the Jat Sikh leader, Ajit Singh) to a stress on maintaining in these circumstances the “honor” of the Jats through resistance to a state that had, as he argued, broken its own undertakings.[111] This was grounded in an ideology of property-holding rights that had been nurtured by decades of colonial rule. Honor (or izzat) was of course a concept closely linked to the morality of “tribal” community and blood, but it was also one deeply embedded in an ideology of village property-holding linked to proprietary village communities.[112] While many of the more wealthy zamindars associated with the Bar Zamindar Association proposed more limited protests, Ajit Singh sought to mobilize Sikh Jat communities in the colonies to act in concert, proposing a refusal to pay water rates and social ostracism from local communities for those who refused to join the protest. The high point of the movement came with a public meeting in Lyallpur city in February 1907 that attracted an estimated 10,000 people.[113] The size of this protest—and its connections to and support from some urban Punjabis—led some government officials, including the new lieutenant-governor, Sir Denzil Ibbetson, to see the agitation as a threat to the very structure of British rule.

The fissures within the government itself, however, soon became evident. While some bought into Ibbetson’s arguments that these protests were part of a larger challenge to British rule linked to the Congress, “urban pleaders,” and the “seditious” partition agitation in Bengal, others noted that the complaints surrounding the Colonization Bill could be just as easily interpreted in terms of long-standing moral grievances intrinsic to irrigation policy, a position with which, as we have seen, many British officials themselves had considerable sympathy.[114] Indeed, the deep-seated nature of the internal divisions in the British position were reflected in the extraordinary character of the ultimate British response to the colony agitation. Although many officials were, as usual, adamant in their unwillingness to appear to yield to a “seditious” agitation (which some linked even to the threat to British rule from the Russians), the appeal of colony **(p.177)** protestors to moral principles associated with irrigator “rights” led the central government to recognize the internal stresses facing the government of Punjab and to ultimately propose a retreat that would underscore the state’s commitment to what some saw as critical legitimizing principles. After much internal debate on how to respond, the government of India decided finally to take the highly unusual action of repudiating the Colonization Bill and refusing to grant its assent to the Punjab legislation. While rejecting the “political” demands of the

(largely urban) Congress that had been linked to the 1907 protests, the central government essentially ordered the Punjab government to reconsider the fundamental issues that had sparked the colony protests.

In the aftermath, the Punjab government appointed a high-level Colonies Committee to inquire into irrigator grievances in the canal colonies. The report of this committee (chaired initially by Sir Thomas Gordon Walker and then by D. C. Baillie) retreated expeditiously from the principles of the 1906 Colonization Bill, which, in light of the protests, it now considered ill-advised. But its report also crystallized the political contradictions in the role of the state—and in its relationship to the environment and local communities—that lay at the very heart of irrigation and colonization policy. Since that time, some historians, most notably Imran Ali, have seen the Colonies Committee report (much of which was enacted into law in the Colonization Act of 1912) as a watershed, marking a politically motivated retreat from the commitment to "agricultural development" that motivated earlier British policy. The larger developmental vision that had marked the expansion of professional engineering and the settlement of the canal colonies on state lands was, he suggests, largely abandoned by the Colonies Committee in the wake of the 1907 protests. The aim of colony policy became instead the assimilation of the colonists into the larger peasant-based and law-based developmental order of colonial Punjab, an assimilation that was closely linked to—and symbolized by—the expeditious awarding to colony settlers of proprietary land rights, perhaps the most important recommendation of the Colonies Committee. By accepting the inevitability of the award of proprietary rights, "the state," in other words, Ali argues, began after 1907 to forfeit its "role as an agent of innovation."[115]

This seriously overstates the case. Whatever the compromises that shaped the report of the Colonies Committee, in reality no full retreat from the developmental policies of the canal colonies, or from a scientific view of the environment, was possible. The new engineering view of the Indus river basin that had shaped colony development had come to stay. That the Colonies Committee report represented no outright rejection of state-led, technicalist development was evident in the fact that the report (and the passage of the 1912 Colonization Act) did nothing to limit the vast expansion of expansion of irrigation on state lands marking the opening of the Triple Canal project and development of other projects that **(p.178)** followed. Indeed, once the Chenab colony and Jhelum colony settlements were complete—and plans for the Triple Canal in train—there was no going back on the larger engineering vision that the canal colonies represented or on the larger environmental view of an integrated river basin.

The committee itself made this clear. While showing sympathy with the claims of customary rights, the members declared their unequivocal opposition to any system that would "surrender the right of Government to use the water to the best advantage in the interest of *the whole community*. Their recommendations have throughout been made in the hope that nothing that they have said will encourage the wasteful or handicap the economical use of water." And if individual irrigators could not be assimilated to such a view, then state authority would have to serve. Powers "to punish the unauthorized use and waste of water," they noted, "are very necessary at all stages of the development of a colony canal for the protection of the majority against the selfish few, as well as for the proper working of the canal. A cultivator who takes water out of his turn or wastes water is injuring some one else."[116] This was a vision in which efficiency, not custom, was paramount, and it was rooted in a conception of the colonies as a transformative and interconnected water environment. The committee held out the hope that the already completed stages of colony development, with their emphases on embedding colonists in

a world of regularity and discipline, would eventually help to transform irrigators themselves—and “have abiding results in the habits and customs of the descendants of the first colonists.”

Yet by strongly recommending the expeditious movement toward the awarding of proprietary rights in the colonies—firmly within the framework of village settlement and “village community” that had already been established—the Colonies Committee also underscored the moral claims of a very different vision of “rights” and development. For whatever the larger environmental vision that defined the canal colonies, the committee report made clear the political importance that the government still attached to a discourse of rights and genealogy embedded in the proprietary ancestral village. In this sense, the committee itself understood clearly the larger implications of its recommendation that colonists be allowed to acquire proprietary rights. “No considerable body of persons have in northern India ever held directly under the British Government otherwise than as proprietors,” the committee declared, “and it has become an ingrained and cherished belief that this status implies security of tenure and moderation and justice in regard to the revenue demand.” The law—and most particularly property law—was, by implication, the source of the strongest moral bond linking the state and the people. The settling of colonists on former state “wastes” in no way justified the withholding of proprietary rights, once the instruments of production were in place, even if they were provided by the state. This was the lesson, they implied (though they did not directly say it), that the colony protests of 1907 had made clear.

(p.179) However, the committee recognized that property law did more than supply simply security of individual tenure. The law also defined a form of community that continued, in many respects, to be in tension with the larger, environmentally defined visions of social order linked to the transformation of the hydraulic environment. For the committee, the inescapable link between the recognition of proprietary land rights and the simultaneous recognition of the primacy of local, “tribal” community was underscored by its emphasis on the need for the full restoration of the operation of “customary” inheritance law. The exclusion of daughters from landed inheritance was, in this framework, at the heart of “ancestral” community, far more than any concern with regularity, order, and sanitation. As the committee saw it, fear of the undermining of “customary” succession rights held by collaterals (in preference to daughters, which was at the legal heart of the idealized meaning of “village community”) had been one of the main concerns that had led to the 1907 protests.[117] The restoration of customary law was thus a key, in their view, in underscoring the government’s recognition of the customary “rights” and assumptions that bound the state to the people. Patriarchy, one might say, was the ground on which government and people met. Even as the committee appealed to a broad image of community defined by environmental interdependency, it reasserted, again, a powerful moral bond between the government and the (male) “peasant” as a foundation for political stability (even if this bond provided potential moral leverage for resistance to the very rules that the state’s larger environmental vision demanded).

The link between environment, community, and morality was evident in the committee’s harking back to “ancient custom” in its references to the relationship between proprietary right and the reclamation of waste. According to custom, “the reclamation of waste and unappropriated land is recognized throughout northern India as giving a title to proprietary rights,” the committee noted, “and in giving lower rights Government will be open to the charge of conceding less than is due by ancient custom.”[118] This was, of course, an argument intended to answer critics who saw the awarding of rights as compromising the state’s transformative environmental mission. But the reference to the rights of “ancient custom” reflected a political calculation—and a

recognition that the state's political position could not just rest on its claims to fully control the hydraulic environment of the Indus basin (which had, in any case, been called into question in the 1907 protests) but would also continue to depend on its ability to control (and manipulate legally for political purposes) another natural environment in the Indus basin: the environment of blood, kinship, and tribal community. When the chief recommendations of the Colonies Committee were thus passed into law in 1912, they crystallized the contradictions that already marked British irrigation policy. As the conflicts of the early twentieth century suggested, the new model of "development" represented by the alliance of state and science—and by the new, integrated conception of the **(p.180)** productive environment that this produced—remained in tension with an older vision of the relationship between the state and local communities, with far-reaching implications for the history of the Indus basin.

Conclusion

The impact of a new vision of a wasteful nature demanding man's disciplined shepherding of water to "command" the land for productive purposes thus wrought profound changes in the Indus basin in the decades after 1890. This empowered a systematic vision of the Indus basin as an integrated hydraulic environment that required new forms of state control over water, land, and people alike. The result was a series of great new engineering projects vastly expanding the scope of irrigation. In the eyes of many engineers, the form of these projects was dictated by the ineluctable imperatives of science and nature. This is why, as the Punjab *Manual of Irrigation Practice* later put it, many engineers conceived of themselves as "content to let their achievements speak for themselves." Politics were in principle rigidly excluded from the ostensibly disinterested science of engineering calculations, even as this attempt to model nature underscored moral claims to power.

Nevertheless, the new systems of hydraulic control instituted in these years, culminating in the opening of the canal colonies and in the audacious Triple Canal project, had critical political implications for how the state related to the people. This took many forms. As historians have long noted, land grants in the canal colonies were used in a variety of ways as political rewards, including for military service. Indeed, canal colony planning was integrated with the needs of the military in broader ways, as Ali has made clear.[119] But the mobilization of science and techniques to transform nature inevitably implied a new vision of power as well, one of community binding society and state. And critical for politics was how this new vision related to the local structures of community and "blood" that had come to be so important to colonial statecraft.

Central to the history of irrigation in this period, as it had been from the very beginning, was the structure of property—that is, of the way that society gave legal form to control over nature. For some, new visions of the environment promised a way to sidestep questions of property, offering direct powers to the state based on new levers of technical control of the environment. This is what empowered the large-scale canal colony settlement of irrigators on newly opened state lands. But the politics of property were so deeply embedded in the structure of colonial power (and thinking) that issues of "proprietary rights" intruded into the structure of the canal colonies (and into all new irrigation systems) almost from the beginning. Perhaps most critically, property in the Punjab (as in every society) was not simply a legal structure of individual or corporate rights but carried in its particularities **(p.181)** deeply held notions about the very nature of the individual and his or her relationship to the definition of communities.

It is little wonder in this context that the political meanings of the great new perennial irrigation projects of the Indus basin were, almost from the beginning, bitterly contested. The protests of 1907 and their aftermath left indelible implications for the subsequent history of the politics of irrigation in the Indus basin. The conceptual structures that defined the colonial response to these protests shaped the history of water in the Indus basin to partition and beyond.

Notes:

(1.) Punjab Public Works Department, Irrigation Branch, *A Manual of Irrigation Practice* (Lahore: Government Printing, 1943), para. 3.50.

(2.) Prakash Tandon, *Punjabi Century, 1857–1947* (Berkeley: University of California Press, 1961), 50.

(3.) Among several important, earlier perennial canals in the province were the (Upper) Bari Doab and the Sirhind.

(4.) Aloys Michel has called the canals of this era a “second wave,” beginning in the 1880s, marked by a new focus on the application of irrigation water to state-controlled “waste-lands.” The notion that state irrigation projects should be directed toward Crown Wastes was, of course, not entirely new. But, as Michel notes, “none of the perennial schemes introduced into the Punjab up to 1882 involved any substantial extension of irrigation to new lands.” Michel, *Indus Rivers*, 74–76.

(5.) India Government, Public Works Dept., *Irrigation in India: Review for 1917–1918* (Simla: Government Printing, 1919), 45–47.

(6.) Gyan Prakash, *Another Reason: Science and the Imagination of Modern India* (Princeton: Princeton University Press, 1999), 160.

(7.) See Mital, *History of the Thomason College of Engineering*. For a brief discussion of Cooper’s Hill in its historical context, see Christopher V. Hill, *South Asia: An Environmental History* (Santa Barbara: ABC-CLIO, 2008), 119–21.

(8.) On the strong link of engineering education in India to the needs of the Public Works Department (hereafter PWD)—and the limits of Indianization in PWD hiring—see Arun Kumar, “Colonial Requirements and Engineering Education: The Public Works Department,” in *Technology and the Raj: Western Technology and Technical Transfers to India, 1700–1947*, ed. Roy MacLeod and Deepak Kumar (New Delhi: Sage, 1995).

(9.) In 1809, the East India Company had opened a military seminary at Addiscombe, and many prominent colonial irrigation engineers, most notably Sir Arthur Cotton, had come out of this context.

(10.) Sir Richard Temple, “Cooper’s Hill College of Engineering,” in his *Oriental Experience* (1883; repr., Delhi: Gian Publishing House, 1986), 304–11.

(11.) Punjab Public Works Department, *Manual of Irrigation Practice*, 3.50–3.52. The engineering problems with the Bari Doab and Sirhind canals, and the general doubts about canal construction that they raised in the 1870s, are discussed briefly in Michel, *Indus Rivers*, 60–61, 71–72.

(12.) Temple, “Cooper’s Hill College of Engineering,” 310.

(13.) Sir William Willcocks, *Sixty Years in the East* (Edinburgh: William Blackwood, 1935), 32.

(14.) Tandon, *Punjabi Century*, 29.

(15.) As C. A. Bayly has argued, the distinctive definition of “public,” as embodied in the phrase “public works,” was associated with a prominent legitimizing vision of state power in nineteenth-century Britain as “disinterested,” that is, non-venal and not self-interested. See C. A. Bayly, “Indian Ecumene and British Public, 1780–1880” (paper presented at the SSRC Conference, “Creating a Public: The European ‘Public Sphere’ and Its Alternatives Under Colonialism,” University of Chicago, October 7–10, 1993), 3.

(16.) T. R. J. Ward (Inspector-General of Irrigation in India, PWD, GOI), “Introduction,” in *Glossary of Terms in Use on Punjab Canals*, ed. H. W. Nicholson (Simla: Government Printing, 1920), 1. Here, of course, the concern with “exact terminology” was also linked to the importance of measurement (and numbers) in defining the professional, apolitical self-image of engineering.

(17.) Robert Burton Buckley, *Facts, Figures, and Formulae for Irrigation Engineers* (London: E. and F. N. Spon, 1908), 124–25.

(18.) Herbert M. Wilson, *Manual of Irrigation Engineering*, 1st ed. (New York: John Wiley and Sons, 1893), 38. Wilson’s textbook was intended for American engineers, yet it drew also on Indian experience.

(19.) M. Norton Wise and Crosbie Smith, “Work and Waste: Political Economy and Natural Philosophy in Nineteenth Century Britain,” *History of Science* 27 (1989): 263–301, 391–449, and 28 (1990): 221–61. I would like to thank Mimi Kim for suggesting these sources. In the realm of scientific thinking, this shift was captured perhaps most prominently in the articulation at mid-century of the second law of thermodynamics—which postulated, through the concept of entropy, the fundamental notion of natural energy systems tending toward ever-increasing disorder.

(20.) H. W. Dickinson, *James Watt: Craftsman and Engineer* (Cambridge, Engl.: Cambridge University Press, 1936), 106. According to the *Oxford English Dictionary*, the term was “introduced” by Watt.

(21.) J. S. Beresford, “Memo on the Irrigation Duty of Water and the Principles on which Its Increase Depends,” Aug. 1875, Punjab Public Works Department, Irrigation Branch, *Remodelling of Distributaries on Old Canals* (Punjab Irrigation Branch Papers, no. 10, 1905).

(22.) R. G. Kennedy, “Note on the Irrigation Duty of the Bari Doab Canal,” April 1883 (Punjab Irrigation Branch Papers, no. 10, 1905).

(23.) Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, Mass.: Harvard University Press, 1987), 57–58. Latour is here using the metaphor of water control to describe the structure of scientific argument. But his metaphor suggests how the model of nature as tending to dissipation defined even the work of the scientist, or engineer himself, in building and controlling a scientific case.

(24.) This did not mean that flow could necessarily be completely equalized over the year, as rabi supplies in the rivers were sometimes below the “full supply” design of a channel (based on available water during the kharif, or flood, season). To maintain full supply to distributaries during periods of low flow in main channels, distributary channels were thus sometimes run on a rotational basis. See Nicholson, *Glossary of Terms in Use on Punjab Canals*, 3–4. Nevertheless, the contrast with inundation canals, which had no head regulators, was dramatic.

(25.) Colonel S. L. Jacob (late of the Punjab Irrigation Department), “Paper on Irrigation and Famine Prevention in the Punjab,” in *Punjab Minutes of Evidence*, Indian Irrigation Commission (Calcutta: Government Printing, 1902), 237. Nevertheless, much evidence was presented to the Irrigation Commission about ways to improve inundation canal irrigation.

(26.) Wilson, *Manual of Irrigation Engineering*, 193.

(27.) Kennedy drew on a long history of published work in hydraulics, much of it from the European continent. He made particular use of the hydraulic formulas of Wilhelm Kutter. But his influence lay in experimental adaptation of these to conditions in the Bari Doab. From the construction of the Lower Chenab canal in the 1890s until well after 1947, Kennedy’s theory of regime channels (modified by Lacey) guided major channel design in the Indus basin. This is not to say that all silt clearance on such channels was given up, but standard bureaucratic practice significantly changed. It was only in the 1960s that, in the Indus basin, the theory of regime channels began to be seriously questioned. For a good discussion of this, see Iqtidar H. Siddiqui, *Irrigation Canals: Planning, Design, Construction and Maintenance* (Islamabad: National Book Foundation, 1979), 93–163.

(28.) Remodeling itself became the subject of complex engineering rules. See Punjab Public Works Department, Irrigation Branch, *General Instructions for the Adjustment of Outlets and Preparation and Sanction of Remodelling Schemes* (Lahore: Government Printing, 1945).

(29.) Note by the Chief Engineer (C. D. Gee), 19 May 1914, Punjab PWD, Irrigation, file no. 78 of 1898, Punjab PWD Secretariat, Lahore.

(30.) For a general overview of the tightening of canal management in the United Provinces, including moves from open cuts to more controlled outlets, see Stone, *Canal Irrigation in British India*, 195–238.

(31.) K. R. Sharma, *Irrigation Engineering*, vol. 1 (Jullundur: India Printers, 1946), 341. Connected with the control of supply levels in channels was the development of distributary head regulators (which could also serve as silt excluders); see ibid., 329–39.

(32.) The problem of developing modules that could gauge outlet deliveries in proportion to shifting canal levels proved extremely difficult. For a discussion of the development of various kinds of modules in the first half of the twentieth century, see Sharma, *Irrigation Engineering*, 340–60. The following paragraph is based on ibid., 365–70.

(33.) This hinged on several factors, such as whether wells also existed as a source of irrigation water in the command area, or whether the spring level along a canal was such as to raise the specter of future waterlogging. Sharma recommended normal intensities of 75–80 percent (which was typical of those instituted in the early colonies), suggesting that 20–25 percent of the culturable land was projected as not being irrigated in any given year.

(34.) Learning such formulas was critical to the training of young engineering students; examples of hypothetical student exam questions of this sort can be found in a later textbook, S. K. Mazumder, *Irrigation Engineering* (New Delhi: Tata McGraw-Hill Publishing, 1983), 180.

(35.) Ward, “Introduction,” 2.

(36.) Michael Lewis, “The Personal Equation: Political Economy and Social Technology on India’s Canals, 1850–1930,” *Modern Asian Studies* 41, no. 5 (2007): 967–94

(37.) Note by R. Egerton Purves, Superintending Engineer, Upper Jhelum Canal, 9 April 1913, Punjab PWD, Irrigation, #38 of 1913 (“Assessment of Occupiers Rates in Connection with the Module Question”), Punjab PWD Secretariat, Lahore.

(38.) Provincial irrigation departments continued to be organized into bureaucratic hierarchies headed by engineers. These departments were administered according to principles that had little to do with mathematical modeling—and so establishing effective control over lower-level irrigation employees remained an ongoing problem.

(39.) On the history of water pricing in the United Provinces, which showed tensions similar to those in Punjab, see Stone, *Canal Irrigation in British India*, 159–94.

(40.) Since calculations of duty helped to determine the distribution of water, they also came, in some cases, to be politicized. For an example of this, in connection with twentieth-century conflicts between Punjab and Sind, see chapter 6.

(41.) The commission was headed by Sir Colin Scott-Moncrieff, a military engineer who was trained at Addiscombe but had served for a time as an administrator at Roorkee, and who was predisposed to take a comprehensive view of the river basin as a framework for irrigation planning as a result of his previous experience in Egypt during the 1890s.

(42.) These were Jacob’s two guiding principles for a new era of large-scale water development. Jacob, “Paper on Irrigation and Famine Prevention in the Punjab,” 236–37.

(43.) Michel, *Indus Rivers*, 83–90. See also James Wilson (Settlement Commissioner, Punjab), “Note on the Means of Irrigation of the Lower Bari Doab,” in *Punjab Minutes of Evidence*, Indian Irrigation Commission (Calcutta: Government Printing, 1902), 225–26, and Jacob, “Paper on Irrigation and Famine Prevention in the Punjab,” 235–47. The plan was also shaped by the desire to reserve the bulk of water in the Sutlej for projects on the Sutlej’s left bank, in which not only the Punjab but Bahawalpur and Bikaner states also had an interest.

(44.) Punjab PWD, Irrigation, #122 of 1914 (“Distributing the Supplies of the Rivers Jhelum, Chenab and Ravi Between the Five Canals”), Punjab PWD Secretariat, Lahore.

(45.) For discussions of the effects of these processes on Sind’s canals, see Bombay PWD (Irrigation), no. 27 of 1906, vol. 259 of 1904–09, Maharashtra State Archives. For discussions on the deterioration of downstream flood-irrigated and inundation canal-irrigated villages as a result of the canal colonies in Punjab, see Punjab, Revenue and Agriculture, Irrigation, December 1900, procs. #36–40 (“Deterioration of Riverain Tracts Due to the Construction of Perennial Canals”), Punjab Archives, Lahore.

(46.) This pattern shaped settlement even on some areas of “waste” in eastern Punjab. As E. G. Wace noted, due to disorder there were—in certain districts such as Karnal, Rohtak, Hissar, and Sirsa—large areas of culturable land that had fallen out of cultivation. British revenue officials carved new estates out of these “wastes” and made them over (ultimately in proprietary right) to those who could bring them under cultivation. Note by Lt.-Col. E. G. Wace, Fin. Comm., 19 January 1888, Appendix to Punjab Revenue & Agriculture, General, May 1888, #6–8 (“Waste Land Rules”), Punjab Archives, Lahore.

(47.) This was a subject of considerable contention. The history of conflict over forest rakh policy, particularly (though not exclusively) in the western Himalaya, is a complex story, and one that at times disclosed the same tensions between “custom” and efficiency seen in irrigation policy. But it is well beyond the scope of this chapter. For a good discussion of the colonial conflicts over forest rakhs, see Vasant Saberwal, “Bureaucratic Agendas and Conservation Strategy in Himachal Pradesh: 1865–1994,” *Indian Economic and Social History Review* 34, no. 4 (Dec. 1997): 465–84.

(48.) This was out of an estimated total of over 23,000 square miles of “uncultivated” *bar* land (which presumably would include village wastes). W. E. D’Arcy, “The Grazing Difficulty in the Punjab Forests,” *The Indian Forester* 10, no. 1 (1884): 167.

(49.) Note by Lt.-Col. E. G. Wace, Fin. Comm., 19 January 1888, Appendix to Punjab Revenue & Agriculture, General, May 1888, #6–8 (Waste Land Rules), Punjab Archives, Lahore.

(50.) This ultimately produced the Sind Sagar Colonization Act of 1902. James Wilson, Settlement Commissioner, Punjab to Sr. Sec. to Fin. Comms., 11 October 1900, Punjab Revenue & Agriculture, General, March 1901, #1–8 (Sind Sagar Doab Colonization Scheme), Punjab BOR, file 251/272.

(51.) Imran Ali provides an excellent overview of the various types of grants and their conditions and how this structure affected the colonies and defined the authority of the state. In the Chenab colony, “Peasant (*abadkar*)” grantees, who occupied the bulk of the land, were settled on long-term leases carrying many conditions. There were, however, other types of grantees, such as “yeoman (*sufedposh*)” and “capitalist (*rais*)” grantees, who could acquire proprietary rights after a qualifying period of five years. Some lands (though in very limited quantities) were also sold at auction with immediate property rights. Imran Ali, *The Punjab under Imperialism, 1885–1947* (Princeton: Princeton University Press, 1988), 19, 64–66. The balance of different types of grants changed somewhat in later colonies.

(52.) Note by Lt.-Col. E. G. Wace, second Fin. Comm., 24 August 1885; Wace to Sr. Sec. to Fin. Comms., 16 Feb. 1884, Punjab Revenue & Agric, General, April 1886 (Settlement of the Sidhnai Lands in the Multan District), Punjab BOR, file 251/92. As J. B. Hutchinson noted, however, in many cases it was impossible for various reasons to draw village boundaries based on a single watercourse. But this should nevertheless be always aimed at, he stated, as the benefits were considerable, particularly in avoiding conflicts over watercourse repairs and turns for water. Maj. J. B. Hutchinson, DC Multan, “Report on the Settlement of the Land Irrigated by the Sidhnai Canal,” 6 July 1888, Punjab BOR, file 251/92.

(53.) Frank Popham Young, “Report on the Colonization of … the Rachna Doab,” 6–9, Revenue, September 1897, A procs, #59–62, NAI. Encouraging the construction and maintenance of such field demarcations was of course a problem. J. B. Hutchinson argued that many colonists saw a

positive interest in the regular demarcation of fields since it made them less reliant on the local *patwari* (village recordkeeper) for field measurements and they could “calculate for themselves if the crop measurements are correct.” But many resented government interference in such matters.

(54.) Ilyas Mohnem, *The Colony Manual* [revised edition of F. B. Wace, *Punjab Colony Manual*, rev. ed., 1933] (Lahore: Pakistan Civil and Criminal Law Publication, 1984), 41.

(55.) Dobson, *Final Report of the Chenab Colony Settlement* (Lahore: Government Printing, 1915), 11.

(56.) *Chenab Colony Gazetteer*, 50.

(57.) “Shades of our ancestors who gave every wood, field and hill in England its appropriate name!” Malcolm Lyall Darling, *The Punjab Peasant in Prosperity and Debt* (1925; 4th ed., Bombay: Oxford University Press, 1947), 133.

(58.) Mohnem, *Colony Manual*, 260. The previous quote, and a discussion of the evolution of the planning of village sites in the Chenab colony, are in B. H. Dobson, *Final Report of the Chenab Colony Settlement*, 10–11.

(59.) Though I would hesitate to push this too far, this mirrors in some ways Foucault’s ideas on the multiple facets of modern disciplinary practices. As Arun Agrawal puts it, much scholarship on modern forms of “governmentality,” influenced by Foucault, has stressed how “modern forms of power and regulation achieve their full effects not by forcing people toward state-mandated goals, but by turning them into accomplices. The very individuality that is supposed to be constrained by the exercise of power may actually be its effect.” Agrawal, *Environmentality*, 216–17.

(60.) Dobson, *Final Report of the Chenab Colony Settlement*, 10–11.

(61.) Mohnem, *Colony Manual*, 260–62.

(62.) Punjab Home, Medical and Sanitary, April 1912, A procs. #1–6, IOL.

(63.) Dobson, *Final Report of the Chenab Colony Settlement*, 10–11.

(64.) As the *Chenab Colony Gazetteer* declared, “[T]he canal made the Colony possible, but it was the railway which made it a success.” *Chenab Colony Gazetteer*, 118.

(65.) Darling, *Punjab Peasant in Prosperity and Debt*, 149.

(66.) *Chenab Colony Gazetteer*, 149.

(67.) Ibid., 151.

(68.) Tandon, *Punjabi Century*, 161.

(69.) The ideal of settlement by village communities was also underscored by Wace: “Companies of agriculturists,” as he put it, would “settle in groups, and form cultivating villages similar to those of the districts from which they would have migrated.” Note by Lt.-Col. E. G. Wace, Second Fin. Comm., 24 August 1885, Punjab Rev. & Agric, General, April 1886, Punjab BOR 251/92.

Aitchison contrasted these cohesive communities (with experience of village community and property) with the more “indolent or inefficient races” of southwest Punjab, many of whom continued to practice pastoralism. H. C. Fanshawe, Offg. Jr. Sec. to Govt. Punjab to Sr. Sec. to Fin. Comms., 27 October 1885, and R. G. Thomson, Offg. Jr. Sec. to Govt. Punjab to Sec. to GOI, Rev. & Agric., 3 November 1885, Punjab Rev. & Agric, General, April 1886, Punjab BOR 251/92. Since it was initially difficult to get central Punjab villagers to resettle to Multan, the Sidhnai population was a mix. Of the land allotted to settlers by 1888, 60,000 acres had been given to local men from Multan and 85,000 to immigrants from other districts. Maj. J. B. Hutchinson, DC Multan, “Report on the Settlement of the Land Irrigated by the Sidhnai Canal,” 6 July 1888, Punjab BOR, file 251/92.

(70.) Letter, Revenue Sec., Punjab, to Sec. to GOI, Rev. & Agric. Dept., 22 July 1891, quoted in Popham Young, “Report on the Colonization of … the Rachna Doab,” p. 10, Revenue, September 1897, A procs, #59–62, NAI. “Capitalist farming in general,” the government continued, “is not a system suitable to the Punjab.”

(71.) As the settlement officer for Amritsar wrote in describing his own priorities for selecting settlers, “[A]s far as possible, groups of men, all connected by common ties and ancestry, should be sent, each group being about enough to take up a whole *mauza* in the Bar.” “Memorandum describing the method of selection of colonists for the Chenab Canal from the Amritsar District” [1893?] by J. A. Grant, Settlement Officer, annexed to Popham Young, “Report on the Colonization of … the Rachna Doab,” p. 22, Revenue, September 1897, A procs, #59–62, NAI. Of course, this is not to suggest that this ideal was not compromised by other British political and administrative concerns. But, in the end, “peasant” grantees made up a little over 78 percent of the total in the Chenab colony. Dobson, *Final Report of the Chenab Colony Settlement*, 64.

(72.) Dobson, *Final Report of the Chenab Colony Settlement*, 4.

(73.) Ibid., 36.

(74.) *Chenab Colony Gazetteer*, 41.

(75.) The British were well aware that certain forms of religion could be cast in direct opposition to structures of genealogical authority. This was reflected in some of C. L. Tupper’s comments on customary law. See, e.g., Tupper, *Punjab Customary Law*, I: 19.

(76.) Popham Young, “Report on the Colonization of … the Rachna Doab,” p. 23, Revenue, September 1897, A procs, #59–62, NAI.

(77.) The colonies brought many new opportunities for migrating kamins, who in many cases improved their economic position and gained new leverage within colony villages. As Dobson put it in 1915, the position of the colony kamins was then one of “substantial prosperity. Even outcast chuhras and chamars are frequently owners of several head of cattle, not to mention their partiality for the lesser orders of livestock. In the occasional unrest which disturbs village society, they easily hold their own by the familiar devices of boycott and combination.” Dobson, *Final Report of the Chenab Colony Settlement*, 82. This was written at a time of fairly high agricultural prices, and the position of kamins later worsened when prices fell. But their relative economic position was generally stronger in the colonies than it was elsewhere in the Punjab.

(78.) Dobson, *Final Report of the Chenab Colony Settlement*, 10–11, 74.

(79.) The exclusion of kamins from gaining regular allotments in colony villages was not only colonization policy but also followed from the terms of the Punjab Land Alienation Act of 1900, which barred those who were not members of “agricultural tribes,” including both nonagriculturists and kamins, from acquiring village land.

(80.) Ali, *Punjab under Imperialism*, 94.

(81.) As government instructions noted: “There will be little to record in many villages, but there is no reason for departing from the usual form.” Punjab BOR, file 251/144 (Chenab Canal. Preparation of a Record of Rights and Annual Papers).

(82.) *Report of the Colonies Committee, Punjab, 1907–8* (Lahore: Civil and Military Gazette Press, 1908), 23. Some officials recognized the irony in applying “customary law” to village communities that had been settled less than a decade or two. The courts too, at times, questioned the foundations for applying customary law in the colonies. But the assumption that colonists carried their customary law with them nevertheless became the dominant legal assumption.

(83.) Some very fragmentary evidence on possible improvements in women’s status in the colonies is given in Malcolm Lyall Darling, *Wisdom and Waste in the Punjab Village* (London: Oxford University Press, 1934), 20–21. On the ways that irrigation may improve many women’s relative economic position, see Pamela Stanbury, “Women and Water: Effects of Irrigation Development in a North Indian Village,” in *Sociology of Natural Resources in Pakistan and Adjoining Countries*, ed. Michael Dove and Carol Carpenter (Lahore: Vanguard, 1992), 372–99.

(84.) Islam, *Irrigation, Agriculture and the Raj: Punjab, 1887–1947*, 141.

(85.) The phrase begins Deva Singh’s 1930 monograph on the Chenab colony. Deva Singh, *A History of Colonization in the Rechna Doab* (Lahore: Government Printing, 1930), 1.

(86.) Darling, *Punjab Peasant in Prosperity and Debt*, 135, 117.

(87.) Dobson, *Final Report of the Chenab Colony Settlement*, 14.

(88.) As Thompson argues in his discussion of late eighteenth-century bread riots, popular resistance to new state policies (and to a new market-based morality) grew out of a popularly perceived “moral economy” linked to the past paternalist undertakings (and moral authority) of the state itself. Resistance was legitimized by the state’s failure to enforce the “rights” that the state itself had previously recognized (in this case, to a fair price for bread). E. P. Thompson, “The Moral Economy of the English Crowd in the 18th Century,” *Past and Present* (1971): 76–136.

(89.) Note, dated 31 May 1909, by W. B. Gordon, Chief Engineer, Irrigation, Punjab, on Complaints against the Canal Administration in the Districts of Multan, Muzaffargarh and Dera Ghazi Khan (with Abstract of Petitions Submitted to the Chief Engineer), Punjab PWD, Irrigation, #412 of 1909, Punjab PWD Secretariat, Lahore. For an overview of inundation canal management during this period, see Punjab Irrigation Branch Papers, #6 (Muzaffargarh Canals), Punjab PWD Secretariat, Lahore, and G. W. Duthy, “Remodeling Inundation Canals in the Muzaffargarh District,” *Minutes of the Proceedings of the Punjab Engineering Congress* 7 (1919): 39–48.

(90.) R. T. Clarke, DC Multan to Commissioner, Multan, 11 August 1908; Extract from Muzaffargarh District Revenue Report, 1906–7, Punjab PWD, Irrigation, #412 of 1909, Punjab PWD Secretariat, Lahore.

(91.) Officials suggested that petitioner awareness of these debates is what, at least in part, prompted the large number of petitions.

(92.) J. M. Dunnett, DC Muzaffargarh, to Commissioner, Multan, 28–29 June 1908, Punjab PWD, Irrigation, #412 of 1909, Punjab PWD Secretariat, Lahore.

(93.) W. R. H. Merk, Commissioner, Multan Division to Sr. Sec. to Fin. Comm., 16 Sept. 1908, Punjab PWD, Irrigation, #412 of 1909, Punjab PWD Secretariat, Lahore.

(94.) Note by C. D. Gee, 19 May 1914, Punjab PWD, Irrigation, #78 of 1898, Punjab PWD Secretariat, Lahore.

(95.) Note, 31 May 1909, W. B. Gordon, Chief Engineer, Irrigation, Punjab, PWD, Irrigation, #412 of 1909, Punjab PWD Secretariat, Lahore.

(96.) Report by E. S. Bellasis, Superintending Engineer, Derajat Circle, 5 May 1909, PWD, Irrigation, #412 of 1909, Punjab PWD Secretariat, Lahore.

(97.) This, too, provoked strong irrigator complaints, but it was also distasteful to engineers since it required ad hoc action and the mobilization of Canal Department subordinates to enforce.

(98.) Hira Singh, MLC, village Narli (Lahore district) to Sir Fazli Husain, 3 December 1927. The protection of rights during remodeling was also linked to the claims of “privilege” in access to water along particular canals. This was put perhaps most blatantly by Nawab Nisar Ali Qazilbash in a petition dealing with Irrigation Department plans to reduce the size of an outlet irrigating his lands on the Niaz Beg distributary outside Lahore. When informed by the canal engineer that his outlet would be reduced in accord with “mathematical calculations,” he replied that his ancestors, who had received earlier British land grants, “did not render service to the British Government after mathematical calculations.” Morally speaking, ancestral rights could not so easily be trumped by science. Petition of Nawab Nisar Ali Qazilbash to DC, Lahore, 5 October 1931, Punjab PWD, Irrigation, #45 of 1907, Punjab PWD Secretariat, Lahore. See also David Gilmartin, “Scientific Empire and Imperial Science: Colonialism and Irrigation Technology in the Indus Basin,” *Journal of Asian Studies* 53, no. 4 (Nov. 1994): 1127–49.

(99.) From the very beginning, establishment of the haq went hand in hand with attempts at the fixation of outlets and with chakbandi operations. For a discussion of early (and problematic) attempts to fix the amount of water delivered to outlets on the Bari Doab canal, see note by Col. H. W. Gulliver, Chief Engineer, Irrigation, 26 March 1879, Punjab Rev., Agric. and Commerce, April 1879, #7, IOL.

(100.) J. M. Douie, Settlement Commissioner, to Sr. Sec. to Fin. Comm., Punjab, 7 June 1906, Punjab, Rev. & Agric. (Irrigation), #6–22, April 1907, in Punjab PWD, Irrigation, #101 of 1905 (“Over-irrigation on the Lower Chenab Canal”), Punjab PWD Secretariat, Lahore.

(101.) Punjab PWD, Irrigation, #74 of 1910 (Discontinuance of the Word “Haq” in Official Papers), Punjab PWD Secretariat, Lahore.

(102.) Dobson, *Final Report of the Chenab Colony Settlement*, glossary of vernacular terms, 2.

(103.) Barrier explains the complex relationship between rural and urban interests during the 1907 protests, particularly those relating to the activities of the Congress, whose strongest influence in Punjab was largely urban at this time, and the Arya Samaj, an important Hindu reform movement in this era. For an overview, see Barrier, “Punjab Politics and the Disturbances of 1907.”

(104.) Many cultivators had discovered, as one official put it, that “the weapon of the law” could be used “to resist the orders of the Colonization Officer.” C. L. Tupper, Minute, 1 March 1901, quoted in Norman Gerald Barrier, “Punjab Politics and the Disturbances of 1907” (Ph.D. diss., Duke University, 1966), 179.

(105.) Dobson, *Final Report of the Chenab Colony Settlement*, 12. This was portrayed, of course, as being for the ultimate good of the people. As the lieutenant-governor of the Punjab, Sir Charles Rivaz, observed in November 1906 after the introduction of the Colonization Bill, if there were unrest over the “new intervention into the lives of the people,” the colonists would realize soon enough that the bill was passed solely for the zamindars’ protection. Barrier, “Punjab Politics and the Disturbances of 1907,” 183–84.

(106.) The very promise of full state control over water supply in the colonies made the government a ready target for irrigators who could now blame inadequate or unpredictable supply directly on the state, whatever the normal vicissitudes of river and canal flow. The shifts in thinking that this entailed were captured by the later comments of Prakash Tandon, whose father had served as a colony engineer, quoted at the beginning of the chapter.

(107.) *Report of the Colonies Committee*, 126.

(108.) The history of waterlogging and its impact on irrigation management will be taken up in more detail in chapter 7.

(109.) Dobson, *Final Report of the Chenab Colony Settlement*, 13.

(110.) Barrier, “Punjab Politics and the Disturbances of 1907,” 187–88.

(111.) For background on the career of Ajit Singh, a Jat who was the uncle of the nationalist martyr Bhagat Singh, see Ibid., 200–208.

(112.) The linking of property and tribal honor was evident, e.g., in the argument that the lack of property rights had undermined the status of colonists in competing in the marriage markets of central Punjab.

(113.) Barrier, “Punjab Politics and the Disturbances of 1907,” 189.

(114.) An example was the former lieutenant-governor, Sir Dennis Fitzpatrick, who had been one of the architects of the Punjab Land Alienation Act of 1900. N. Gerald Barrier; “The Punjab Disturbances of 1907: The Response of the British Government in India to Agrarian Unrest,” *Modern Asian Studies* 1, no. 4 (1967): 353–83.

(115.) Ali, “Malign Growth?,” 121. This is an oversimplification of Ali’s argument, but it captures the gist. Others have viewed the protests differently. Richard Fox sees the protests as a

manifestation of an incipient “lower-middle class consciousness” linking the Arya Samaj and rural property owners, a consciousness that was ultimately overwhelmed by the rise of communalism in the province. Richard Fox, *Lions of the Punjab: Culture in the Making* (Berkeley: University of California Press, 1985), 166. Indu Agnihotri, in contrast, stresses the ecological pressures of the new canal systems on irrigator livelihoods, whatever the “modernizing” intentions of the British. See Indu Agnihotri, “Ecology, Land Use and Colonisation: The Canal Colonies of Punjab,” *Indian Economic and Social History Review* 33, no. 1 (1996): 37–58.

(116.) *Report of the Colonies Committee*, 126, 18, 125 (emphasis added). Note that the committee proposed that the enforcement of rules should eventually be based on complaints of waste coming from irrigators (and village panchayats) themselves, thus suggesting the gradual assimilation of irrigators to a larger engineering worldview.

(117.) Although the operation of custom had long been recognized in the colonies, some court decisions had, the committee noted, raised questions about the operation of customary law, as had new conditions proposed in the Colonization Bill. But, it argued, the “attachment of the great body of colonists to their customary law,” including the exclusion of daughters from landed inheritance, remained “unquestionable.” Even when it is a question of the succession of a daughter’s son versus a collateral, “those colonists who are not biased by personal circumstances almost unanimously declare for the succession of the collateral where the customary law is in favour of it.” Much of the discussion in the report focused on how customary succession could be protected even before proprietary rights were attained. *Report of the Colonies Committee*, 24–25.

(118.) *Report of the Colonies Committee*, 19.

(119.) Ali, *Punjab under Imperialism*, 109–57.