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Performance evaluation of right main canal command of West Banas irrigation project by using equity

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Abstract
The sufficiency of water supply was discovered acceptable at head and center segment where as helpless ampleness was found at tail area. The normal entryways sufficiency pointer for Right Main Canal was found as 0.78 which shows helpless ampleness of water conveyance for water system season 2017-18. Equity in water supply for Right Main Canal was discovered acceptable to reasonable at head and center segment though 'poor' value was found at tail segment. The normal reliability for Right Main Canal was found as 0.12. Generally constancy for Right Main Canal shows reasonable ideal dispersion of water. The normal stockpiling effectiveness was discovered to be 84.52 percent showing great stockpiling limit of the dirts in the order zone. The normal estimation of transport productivity at head, center and tail segments of Right Main Canals were gotten as 76.02 percent. Area consistency was discovered reasonable for poor showing inconsistent circulation of water as for zone of every minor. Application proficiency was discovered acceptable (80.42) demonstrating water is applied viably and effectively to the land.

Keywords: water, conveyance efficiency, equity, right main canal, field water use efficiency

1. Introduction
The achievement of a water system water-conveyance framework can be estimated by how well it meets the destinations of conveying a satisfactory and reliable inventory of water in an impartial, effective way to clients served by the framework. On the off chance that water doesn't show up at ranches in a satisfactory and convenient sum, crop yields may endure and cultivate net returns may diminish. Likewise, it is significant that every rancher gets a decent amount, while not exorbitant, measure of water.

An essential worry of water-conveyance frameworks is to convey the measure of water needed to satisfactorily flood crops. The necessary sum, decided as that expected to accomplish the given horticultural approach, is an element of the territory of land inundated, crop wasteful use prerequisites, crop-water creation capacities, application misfortunes, and social practices, for example, land planning and salt draining. Sufficiency of conveyance is subject to water supply, indicated conveyance plans, the limit of pressure driven structures to conveyance, water as per the timetables, and the activity and upkeep of the pressure driven structures (Molden and Gates 1990).

The ampleness can be assessed for a water system framework overall, or for subsystems and sub-order zones. Locally, for an off take, the sufficiency is basically the proportion of genuine to required conveyance. The ampleness is registered utilizing the condition (3.2) and the qualities lower than 1 shows the insufficient conveyed water while the qualities higher than 1 show that the conveyed water is all that could possibly be needed.

Note that the ampleness esteem becomes 1 if the conveyed release is higher than the focused on or required release, demonstrating that this pointer won't punish the water client for getting more water than planned. Yet, this may likewise make a natural issue and proficiency issue if the water supply is a lot as the marker doesn't demonstrate what is the greatness of water that is over the focused on stock.

2. Materials and Methods
2.1 Description of the Study Area
The West Banas Dam was constructed on West Banas River. The river Originated from eastern side of Sirohi town and flows in South west direction through Sirohi district of Rajasthan and Banas Katha District of Gujarat state and ultimately flows in to the run of Kuchha. The dam is situated near village Dhanari about 3.0 km North West to Swarupganj

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Railway station of Northern-Western Railway on Delhi-Ahmedabad main rail line and of its co-ordinates are Latitudes 24˚ 41'N Longitudes 72˚ 56'E.

The West Banas irrigation project was sanctioned by Govt. of Rajasthan vide letter No.F-2(42)/Irrigation/156 dated 22/05/1958 for Rs.4800300/-only. The Dam was proposed on West Banas River near village Dhanari. This Project is medium irrigation project with CCA of 7952 Ha. And Commissioned during the year1962-63 originally irrigation project was envisaged an area of 5566 Ha. To be irrigated with irrigation intensity of 70%. The Dam gives irrigation benefits to the 36 villages of Pindwara and Abu road Tehsils. The construction of dam was started in the year 1958 and was completed in the year 1963. The project was revised for 64.21 Lacks. On its completion.
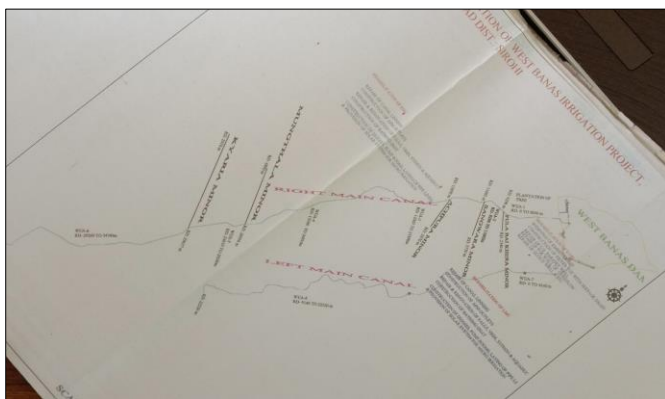

Fig 1: Location of study area

2.2 Performance Evaluation of Right Main Canal by Equity

An essential worry of water-conveyance frameworks is to convey the measure of water needed to satisfactorily flood crops. The necessary sum, decided as that expected to accomplish the given horticultural approach, is an element of the territory of land inundated, crop wasteful use prerequisites, crop-water creation capacities, application misfortunes, and social practices, for example, land planning and salt draining. Sufficiency of conveyance is subject to water supply, indicated conveyance plans, the limit of pressure driven structures to conveyance, water as per the timetables, and the activity and upkeep of the pressure driven structures (Molden and Gates 1990).

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shows the insufficient conveyed water while the qualities higher than 1 show that the conveyed water is all that could possibly be needed.

$$P_A = \frac{1}{T}\sum_{time}\left(\frac{1}{R}\sum_{area} P_A\right) \qquad \text{…. (3.2)}$$

Where:
The terms Q_D and Q_R are, respectively the amounts delivered and required.

Where,
P_A - the presentation measure comparative with sufficiency at subsystem or framework level;
P_A - sufficiency for a solitary point (for example off take) or just conveyance execution proportion;
Q_D - the genuine measure of conveyed water;
Q_R - the expected (required) measure of water;
R - Region served by the framework (optional waterways for this examination);
T - Time period (water system season).

Note that the ampleness esteem becomes 1 if the conveyed release is higher than the focused on or required release, demonstrating that this pointer won't punish the water client for getting more water than planned. Yet, this may likewise make a natural issue and proficiency issue if the water supply is a lot as the marker doesn't demonstrate what is the greatness of water that is over the focused on stock.

3. Results and Discussion

The Adequacy of water supply for Right Main Canal was estimated regarding Gates Adequacy Indicator (GAI). It is the proportion of genuine water conveyed (Q_D) to required measure of water (Q_R) to inundate crops. Q_D is the conveyed water estimated as release (Cumec) at every minor of trench during entire season from November to March. It was then changed over to volume of water (m3) provided in every month to the 4 yields filled in waterway order in Rabi season. Q_R is the measure of water needed by crops to fulfill their water system needs. The CROPWAT 8.0 programming was utilized for calculation of CWR for each yield in mm for every month. These qualities were then changed to volume of water by duplicating CWR of each harvest to the developed zone of every minor. In present investigation, all minors were separated in three sections as head, center and tail segment of Right Main Canal. The assessed estimations of Q_D and Q_R are given in Table 1 it shows higher stockpile of water at head from November to March. These qualities are diminishing from head to tail with expanding distance and low estimations of redirected water were seen at last part.

**Table 1:** Values of Q_R and Q_D for Different Months at Each Outlet

Year (2017-18)	Minor	November (10^3 m³)	December (10^3 m³)	January (10^3 m³)	February (10^3 m³)	March 10^3 m³)
		Q_R Q_D	Q_R Q_D	Q_R Q_D	Q_R Q_D	Q_R Q_D
Head	Fula Bai Khera minor	3.7 15.8	9.3 14.8	14.3 16.6	17.2 16.7	12.1 20.4
	Sangwara minor	12.3 85.3	47.3 86.1	68.4 83.7	74.4 79.4	53.4 77.8
Middle	Achpura minor	7.8 15.7	34.8 38.7	72.4 60.9	84.3 75.7	28.6 22.9
Tail	Mungthala minor	162.5 185.4	458.4 127.4	690.7 470.6	875.4 289.7	322.7 149.9
	Kyaria minor	18.3 11.4	25.4 11.7	75.4 19.2	84.3 23.4	45.8 10.4

Table 1 gives proportion of QD and QR for every source from November to March. The proportion acquire esteem one when QD is more noteworthy than QR that infers a sufficient measure of water conveyance while proportion between 0.80-0.89 specifies 'reasonable' and under 0.80 designates 'poor' ampleness. Transient normal of Gates Adequacy Indicator goes from 1.00-0.85 at head, 0.82-0.77 at mid and 0.50-0.30 at tail part of trench. The normal of GAI for head area was found as 0.99 specifying 'great' sufficiency. Additionally, at waist, its worth was estimated as 0.91 demonstrating 'reasonable' ampleness and for tail part it got estimation of 0.47 suggesting 'poor' sufficiency likewise appeared in Figure. In Table 1, spatial normal estimations of sufficiency for all sources were likewise estimated for every period of Rabi prepare and change from 0.69 to 0.93. The qualities were noticed most noteworthy in the period of November and December demonstrating 'reasonable' ampleness in the two months while 'poor' in rest of the months having values 0.75, 0.71 and 0.69 in January, February and March individually. Figure 2 delineate graphical portrayal of spatial normal estimations of GAI for every month in Right Main Canaal.

The general normal of both spatial and fleeting normal of sufficiency pointer was determined which got estimation of 0.79 demonstrating 'poor' ampleness of water conveyance situation in Right Main Canal for time of study (2017-18).

Table 2: Average value of gates adequacy indicator

Location of Minor	Outlet No.	Ratio Q_D / Q_R					GAI	Average
		NOV	DEC	JAN	FEB	MARCH		
Head	Fula Bai Khera minor	1.00	1.00	1.00	1.00	1.00	1.00	0.99
	Sangwara minor	1.00	1.00	1.00	1.00	0.97	0.99	
Middle	Achpura minor	1.00	1.00	0.84	0.89	0.80	0.91	0.91
Tail	Mungthala minor	1.00	0.28	0.68	0.34	0.46	0.56	0.47
	Kyaria minor	0.63	0.46	0.26	0.28	0.23	0.38	
Average		0.93	0.81	0.75	0.71	0.69	0.78	
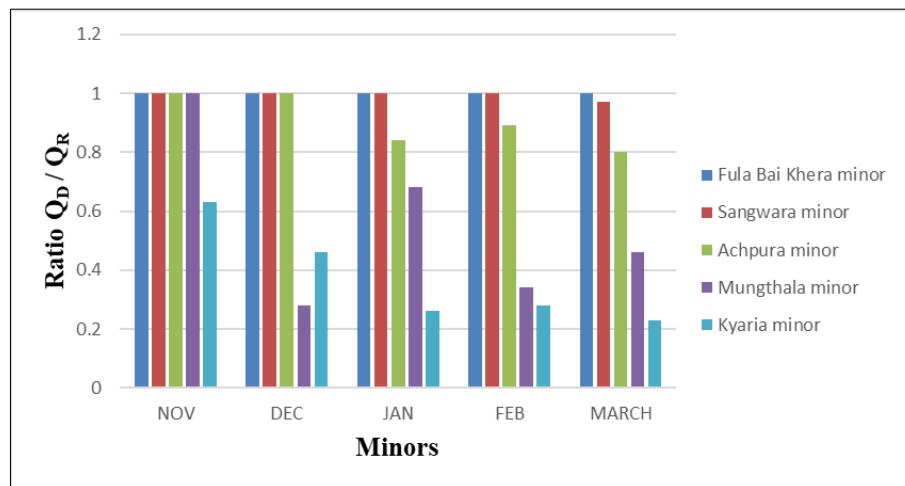
Fig 2: Temporal Average value of Gates Adequacy Indicator
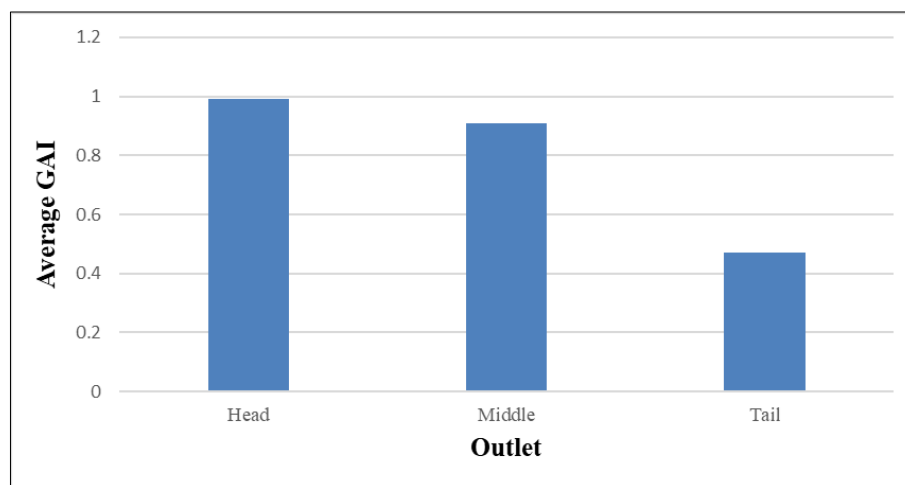
Fig 3: Average GAI value at Head, Middle and Tail of RMC

4. Conclusions
The water conveyance execution incorporates – ampleness, constancy and value which were determined for water system period of year 2017-18. Spatial normal estimations of Gates Adequacy Indicator (GAI) for Right Main Canal, normal estimations of Gates Adequacy Indicator found as 0.99, 0.91 and 0.47 at head, center and tail reach, individually. For Right Main Canal, Temporal normal of sufficiency was found as

0.93 for November demonstrating 'great' ampleness in water supply and it was seen as 0.81 in December demonstrating 'reasonable' ampleness in water supply while 0.75, 0.71 and 0.69 found for January, February and March month individually showing deficient water conveyance. The general ampleness of Right Main Canal was acquired as 0.78 which is considered as 'poor'.

The constancy at head, center and tail segments of Right Main Canal was acquired as 'poor' with CVT estimations of 0.02, 0.12 and 0.23, separately. Unwavering quality of entire West Banas channel network in water conveyance is 'poor' with normal estimation of 0.25. Value at head got was 'acceptable' from November to February with CVR estimation of 0 and 0.04 in walk. The value was discovered 'acceptable' in November and December and discovered 'reasonable' in Feb. Furthermore, discovered 'poor' in Jan and March for center segment. Tail segment of Right Main Canal has indicated 'reasonable' value in November having CVR estimation of 0.16. 9-Whereas 'poor' value was gotten in the excess month having CVR esteems going from 0.21 to 0.47.

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