

DRAFT TECHNICAL PAPER
DEVELOPMENT OF ORDERED WATER VERSUS DIVERSION FACTORS
FOR WATER MANAGEMENT PLAN WATER AVAILABILITY MODELING
Nov. 29, 2018

Agricultural diversions are not necessarily the same as agricultural demands in the lower Colorado River basin. This is due to an advance order requirement of up to seven days (or longer) in order to provide water supplies in a reliable manner. To more accurately simulate releases to meet agricultural demands, factors were calculated as the average of actual orders and diversions for irrigation seasons of 2001 to 2016.

Background

Orders. Each day, the three LCRA-operated irrigation divisions (Garwood, Lakeside and Gulf Coast) and Pierce Ranch (independently operated) estimate their future daily water demands based on equipment capacities, acreage planted and individual farm orders. The amount of time it takes to deliver water released from Mansfield Dam to downstream irrigation operations can be up to seven days (or longer) and delivery to locations at the ends of the canal systems can add additional days. Therefore, the irrigation operations must forecast their demands several days in advance of the actual diversion.

Releases. On a daily basis, LCRA's River Operations Center (ROC) determines the sources of water available to meet the forecasted demands requested by each of the irrigation operations. Sources include the amount of downstream run-of-river flows the ROC reliably foresees occurring, City of Austin return flows, actual inflows into the Highland Lakes for which there is a senior downstream demand, and stored water from lakes Buchanan and Travis made available in accordance with the LCRA's Water Management Plan (WMP). Based on the availability of these sources and water right priority, the ROC determines each day how much water must be passed through lakes Buchanan and Travis or released from storage in the lakes to satisfy the downstream demands for diversions or environmental needs that will occur over the next several days.

Diversions. Diversions are made by each of the irrigation operations based on current weather conditions and daily demands. Garwood Irrigation Division has a single pump station and a small on-channel reservoir, created by a low head dam on the Colorado River, from which to pump water. Lakeside Irrigation Division has one pump station on the river but no reservoir on the river and must capture water as it flows by. The Pierce Ranch operation has a single pumping station and no on-channel reservoir. Gulf Coast Irrigation Division has pumping stations located on both the east and west banks of the Colorado River and has small pumping reservoirs created by on-channel dams at Lane City and Bay City.

Diversions by the irrigation operations sometimes vary from requested orders based on several factors, particularly local or regional rainfall events that can cause an interruption or reduction in the amount of water actually diverted by each irrigation operation. The

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difference between the water ordered and released and water diverted represents an operational inefficiency accounted for in the modeling of the WMP. The water not diverted at the irrigation operations helps meet freshwater inflow needs and demands for other users that do not require a steady or constant supply of water, such as STPNOC.

Methodology

Historic release and diversion data demonstrates that actual releases from lakes Buchanan and Travis are larger than the actual diversions. This is because orders do not reflect that rainfall and other unforeseen events over the travel time period of several days may result in reduced diversions or a complete shutdown of diversion pumps. Use of diversion data alone would underestimate actual irrigation water demands on the Highland Lakes.

LCRA has developed factors to characterize the difference between orders and diversions for each irrigation operation. Orders determined using these factors simulate demands on the overall system to estimate reservoir releases, which more closely approximates observed system operations. The difference between orders and diversions is higher in seasons with more rainfall and lower in seasons with little rainfall. LCRA developed different factors for wet, moderate and dry seasons. A wet season was considered when rainfall was greater than 19.7 inches in first season months (March to July) and greater than 13.4 inches in second season months (August to October). A dry season was considered when rainfall was less than 13.4 inches in the first season and less than 8.1 inches in the second season. Seasons with rainfall in between these thresholds for wet and dry were classified as normal. Aerial rainfall for Texas Water Development Board quadrangle 811 as revised in 2017 was used for the classification.

RESULTS

LCRA staff analyzed the actual records of orders and diversions by irrigation operation for the period of 2001 through 2016 for the years they operated. The percentage of water ordered that is diverted, on average, is shown in Tables 1, 2 and 3. The additional percentage factor added to demands in the WMP Water Availability Model to determine the simulated orders is determined by taking of the inverse of the percentages in Tables 1, 2 and 3 and subtracting 1.0. The resulting factors are shown in Exhibits 4, 5 and 6.

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Table 1 – Average Wet Seasonal Diversions as Percentage of Orders by Operation

| Season | Garwood | Lakeside | Gulf Coast | Pierce Ranch |
|--------------------------------------|---------|----------|------------|--------------|
| First Season (March to July) | 63% | 58% | 80% | 62% |
| Second Season (August to October) | 76% | 59% | 83% | 76% |

Table 2 – Average Moderate Seasonal Diversions as Percentage of Orders by Operation

| Season | Garwood | Lakeside | Gulf Coast | Pierce Ranch |
|--------------------------------------|---------|----------|------------|--------------|
| First Season (March to July) | 76% | 74% | 85% | 70% |
| Second Season (August to October) | 78% | 65% | 88% | 63% |

Table 3 – Average Dry Seasonal Diversions as Percentage of Orders by Operation

| Season | Garwood | Lakeside | Gulf Coast | Pierce Ranch |
|--------------------------------------|---------|----------|------------|--------------|
| First Season (March to July) | 82% | 83% | 88% | 77% |
| Second Season (August to October) | 82% | 75% | 83% | 76% |

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Table 4 – Additional Percentage to Add to Wet Seasonal Demands

| Season | Garwood | Lakeside | Gulf Coast | Pierce Ranch |
|--------------------------------------|---------|----------|------------|--------------|
| First Season (March to July) | 58% | 72% | 25% | 62% |
| Second Season (August to October) | 32% | 71% | 20% | 32% |

Table 5 – Additional Percentage to Add to Moderate Seasonal Demands

| Season | Garwood | Lakeside | Gulf Coast | Pierce Ranch |
|--------------------------------------|---------|----------|------------|--------------|
| First Season (March to July) | 31% | 35% | 17% | 43% |
| Second Season (August to October) | 31% | 55% | 14% | 57% |

Table 6 – Additional Percentage to Add to Dry Seasonal Demands

| Season | Garwood | Lakeside | Gulf Coast | Pierce Ranch |
|--------------------------------------|---------|----------|------------|--------------|
| First Season (March to July) | 22% | 20% | 13% | 29% |
| Second Season (August to October) | 22% | 33% | 21% | 32% |