KERN WATER BANK
OPERATIONS MANUAL

MANAGEMENT OF OPERATIONS & MAINTENANCE

Recharge Basins. The operation of the recharge basins will be managed to maximize the use of available water supplies and to minimize costs for conveyance and operation. By adaptive management of the water recharge operations, benefits for wildlife will be enhanced. The basins will be designed into several systems, each of which will be a chain of basins, interconnected by canals which will allow flexibility in delivery areas.

Within each chain, which may change from time to time, the water will flow from basin to basin through an interbasin structure which will control the water level in the preceding basin and the flow rate to the next basin in the chain. To the extent possible to prevent impacts on nesting birds, the basins, for the period March through July, shall be kept at a constant level, except for the basins at the end of a chain which will be used to accommodate fluctuating flows.

Water Spreading Frequency. The frequency and area of recharge on the KWB is important for environmental purposes. Flooding encourages wetland habitat at the expense of upland habitat. A model was developed to estimate available supplies, and frequency and area of recharge on the Kern Water Bank. The model simulates the supply of water from four primary sources: SWP entitlement, interruptible entitlement, CVP 215 water and high-flow Kern River water.

Interruptable entitlement becomes available after San Luis Reservoir has filled, when there is surplus pump capacity, when there is surplus Delta outflows under the current Delta standards, and when there is capacity in the Cross Valley Canal. The availability of high-flow Kern River water depends both on yield, prior obligations for this water, and reservoir storage capacity. Only part of the April-July yield can be stored and regulated. Availability of CVP 215 water depends on runoff, reservoir storage capacity, in-river uses, irrigation demand, and Friant-Kern Canal capacity. The model simulates these conditions using annual hydrology and average demands.

Given the above supplies, together with SWP firm yield, the quantity of water recharged on the Kern Water bank is calculated. Regulated and unregulated water are treated separately. The recharge of the unregulated supplies is calculated as the minimum of the total unregulated supplies available in a month and the recharge capacity for that month. The regulated supplies are used to maximize the wetted area during the nesting season, which is assumed to be April through July. The regulated supplies complement the unregulated supplies to maintain the greatest area wetted during this four month period.

Infiltration rates vary by month due to changes in water temperature. The rates used in the model vary by month, but are fixed for each month. The estimates for each month were based on historical information tempered with practical input from the project manager. The model assumes a storage limit of one million acre feet, a migration factor of 4% and a recovery demand of up to 250,000 acre feet per year. Based on the quantities available and the infiltration rate, the wetted acreage is calculated by month.

The availability of SWP entitlement is based on current conditions. Over time, the SWP allocations may decrease on average as the demands by contractors increase. However, there is likely to be water in the SWP "turnback pool" in the wet years for many years to come, and this has not been factored into the available supply. Neither does the model attempt to account for flood waters. Flood waters are available in large quantities for short periods in years when other cheap supplies of water are also available. Including flood waters in the analysis is likely to have little impact on the model results.

The frequency and area of recharge are estimated in the final stages of the model and the results are depicted graphically. The model showed that there was sufficient water to flood 3,000 to 4,000 acres, some time during the year, in 50% of years. The model does not account for the willingness of participants to finance recharge operations. This is an unknown quantity that is difficult to simulate. Based on the model and subjective adjustment for participant willingness the frequency in which the basins will be used for recharge is projected to vary; 5900 acres are estimated to be flooded infrequently (1 year in 10); 4830 acres are estimated to be flooded on a intermediate basis (2 years in 10); and 2,110 acres are expected to be flooded frequently (5 years in 10). The duration of flooding each year will vary depending on weather conditions.

WATER SOURCES

The KWB can receive water from three sources: the State Water Project (SWP) though the California Aqueduct from the west, and the Kern River and the Friant/Kern Canal from the east. Deliveries from west will utilize the western basins first to reduce pumping costs. Deliveries from the east will utilize eastern basins first. The following sections describe the hierarchy in which the systems are projected to be utilized (see Map 4 for basin locations).

<u>State Water Project</u>. Participants of the Kern Water Bank Authority have contracts with the Kern County Water Agency for SWP entitlement. Also available to the participants is SWP intermittent entitlement. Delivery of their entitlement water varies depending of many factors including rainfall, weather conditions, reservoir storage, etc. DWR will, in the spring of each year, notify the contractors what the allocation will be for the year. The participants will then evaluate their requirements and determine amounts to be banked on the KWB.

Typical hierarchy for delivery locations of SWP water from the California Aqueduct in cubic feet per second (cfs):

0-100 cfs	Main Basins
100-160 cfs	North Basins
160-360 cfs	Strand Basins
360-520 cfs	River Basins
520-600 cfs	James Basins

Kern River and Friant Kern Canal Deliveries. Delivery of water from the Kern River and the Friant Kern Canal will be both regulated and unregulated water and will be available in varying amounts. The delivery of this water to the KWB will be from the east and will utilize the recharge systems in the order of the following table. When the water source can be regulated, a flow rate will be calculated to maintain the deliveries through the waterfowl nesting season when possible.

Typical hierarchy for delivery of Kern River and Friant-Kern Canal water by flow rate in cubic feet per second (cfs):

0-160 cfs	River Basins
160-220 cfs	James Basins
220-400 cfs	Main Basins
400-600 cfs	Strand Basins
600-700 cfs	North Basins

MAINTENANCE OPERATIONS

Maintenance of Recharge Basins. Maintenance of the basins will include the control of tumbleweeds and other growth if it interferes with recharge activities. This control may be accomplished by hand, lightweight equipment, grazing or burning. Equipment may also be used to remove silt build-up when it interferes with recharge activities. When feasible, islands in the recharge basins will constructed from the spoil of the silt removal process.

The basins will be designed into several systems and will be located on the property to take advantage of the different sources of available water. A hierarchy of basin filling will be established so when water is recharged, specific basin systems will be utilized frequently, while others may only be filled on an occasional basis.

Within each chain the water will flow from basin to basin through an interbasin structure which will control the water level in the proceeding basin and the flow rate to the next basin in the chain. To prevent impacts on nesting birds, the basins, to the extent possible for the period March through July, shall be kept at a constant level, except for the basins at the end of a chain which will accommodate fluctuating flows.

If a basin has been idle for more than two years, subsequent filling shall be done slowly, mimicking heavy rainfall, so that any covered species that may have inhabited the basin bottoms or sides may escape before drowning occurs.

Idle Recharge Basins. There will be some basins that are not be utilized for water spreading every year. These basins will have to be monitored and managed if needed to prevent invasion by tumbleweed and other noxious weeds by grazing, burning and mowing of the basin bottoms and the surrounding levees.

Canal and Basin Bank Management: Seasonal release, conveyance and storage of water results in emerging native wetland vegetation in canals and basins. Management methods under consideration for canal and basin bank vegetation include grazing, mowing and burning. Mowing is proposed to maintain seasonal wetland vegetation on the basin edges adjacent to roads. Riparian vegetation on promontories, peninsulas, and islands will be allowed to achieve full canopy cover. When basins are to remain dry for extended periods, prescribed grazing and burning will be used for weed control.

Fresh Water Marsh: Fresh water marsh habitat is best developed in areas containing nutrient-rich saturated soils in locations with slow-moving water. Marsh species are rapid colonizers and respond to seasonal inundation, and are often associated with riparian woodlands. The adjacent City of Bakersfield's 2800 acre recharge site is a prime example of mature marsh and riparian forest habitat. Typical plants of the fresh water marsh include tule (*Scirpus acutus*), willow (*Salix hinsiana*), cattail (*Typha latifolia*), spikerush (*Eleocharis Cyperus*), and rushes (*Juncus spp.*). Management programs for fresh water marsh habitat will be dependent upon analysis and selection of suitable marshland habitat within the basin system and proximity to adjacent existing marshes. Placement of the marshland will be determined by availability of water. Exotic tree and plant control programs may include selective herbicide and controlled burning programs.

Water Wells During a pumping season, each well site will be checked by a system operator on a regular basis. This person will take flow and electrical meter readings and will also perform facility operation checks on the motor, pump, lubrication and electrical systems. Periodically, ground water levels will be measured and water quality samples will be taken at each production well. In non-pumping years, each well will be run periodically to test the basic operation of the equipment. In the event of a malfunction, the following table identifies typical maintenance procedures.

Item	Equipment	Nature of Work	Frequency
Motor repair or replacement	Maintenance truck and crane	Remove motor and transport to shop	Every three to five pumping seasons
Pump repair	Pump service rig, crane and maintenance truck	Pump and column pipe are removed from well, serviced and reinstalled	Every three to five pumping seasons
Miscellaneous site work	Motor grader, water truck, backhoe, pickup truck	Vegetation removal and well pad maintenance	Yearly
Electrical repair	Maintenance truck	Cleaning of electrical panels and switch gear and replacement of components	Quarterly during pumping season

Roads, Canals and Levees. Maintenance work on roads, canals and levees will be based on routine inspections during operating periods and periodically during non-operating periods. Typical work will include: clearing vegetation; grading roads, levees, canal side slopes and canal bottoms; mowing of vegetation; repair and replacement of weak sections of levees; removal of silt and repair of erosion.

Vegetation removal from roadways, turnouts, interbasin structures, road crossings and control structures will be accomplished by burning, motor grading, mowing, herbicides or by hand. Use of motor graders utilized for roads, canals and levees will be minimized. Silt removal from canals and recharge basins will be by excavators, backhoes or loaders. Where seepage of water through levees is identified, backhoes will be utilized to make the repair.

CONSTRUCTION AND REHABILITATION OF FACILITIES

Recharge Basin Construction. The recharge basins will be built utilizing the natural topography by constructing low earth berms to serve as levees along contours of the land. The levee will be built utilizing soil adjacent to the levee inside the basin. Typical construction will include pad clearing, soil moving and soil compaction, following existing practice.

Recharge Conveyance Canal Construction. The conveyance canals will be sized as required to convey water from the turnout structures to the recharge areas. Canals will have associated turnouts, weirs, flow control, measurement structures and road crossings as required.

Typical canal construction methods will consist of cuts and fills with excavation equipment. Cuts and fills will be balanced to minimize haul distances along the construction corridor. If additional fill material is required, borrow areas immediately adjacent to the canals will be identified and used for construction. Motor graders, water trucks, compactors and loaders will also be used for construction.

Existing Water Well Rehabilitation. Field clean motors, pumps and electrical panels. Check out all equipment and evaluate if service is required. Transport equipment to shop if service is required or purchase new equipment. Install pump equipment consistent with current electrical and mechanical codes prior to start-up. Construct conveyance facilities such as temporary surface pipe, permanent buried pipe, and canals.

Construction of New Wells. Dig sump for retention of water used for drilling and discharge of drill cuttings. Set up drilling rig and drilling pipe trailer at well site. Drill well, install casing, gravel, concrete seals, pump, motor, concrete pad, electrical equipment and discharge piping.

Construction of Underground Recovery Pipelines. Lateral pipeline construction will consist of clearing, trenching, pipe delivery, unloading, pipe installation, backfilling and final grading. The initial operation will include clearing of the proposed alignment of the pipeline. Trenching will be accomplished with either an excavator or trencher with the spoil pile to be located directly adjacent to the trench. Pipe will be delivered by trucks and unloaded using a crane or forklift along the trench in position for pipe laying activities. A crane will hoist and position the pipe in the trench. A loader will move soil excavated from the trench to backfill the pipe. Compaction equipment will be utilized to achieve required compaction. After backfilling is complete the pipeline corridor will be final graded with the excess material being mounded over the pipe to allow for settlement.

Construction of Recovery Canals. Recovery canals will ultimately be concrete lined connecting recovery pipelines and recovery wells to off site conveyance facilities. The canals will be constructed similar to the recharge canals described above but will have a concrete lining. After the canal is excavated, forms for the placement of concrete will be installed. Concrete trucks will deliver concrete to the site, to be placed in the forms and finished.

Supply/Recovery Canal Construction. The supply/recovery canal will ultimately be concrete lined and will convey water to the recharge areas and from the recovery wells. It will be sized for both activities. Construction for the canal will be similar to the construction of the recovery canals. The supply/recovery canal will be located within the zone as shown on the Map 2, Permit Area.

Pump Station Construction Where necessary pump stations will be constructed to convey water. The sites will be cleared, grubbed and moisture conditioned. Excavation will be required to allow for construction of concrete retaining walls and foundations. Pumps, motors and electrical panels will be installed. This effort will require cranes, delivery trucks, water trucks, compactors, excavators and graders.

Kern River Reverse Flow. The Kern River Channel may be utilized to convey water from the California Aqueduct to the recharge areas. At two or more locations along the existing river bed sand berms may be constructed utilizing scrapers, water trucks, bulldozers and graders.

At these locations, pumps and bypass pipelines will be installed. Pile drivers will install piles for support of pump platforms. Piping, pumps and motors will be installed using cranes, delivery trucks and back hoes. Control structures will be constructed using similar equipment.

Equipment Used for Construction of Recharge and Recovery Facilities:

Self-loading scrapers	Pump Pulling Rig	Compaction Equipment
Graders	Bulldozers	Backhoes
Dump Trucks	Service and Fuel Trucks	Water Trucks
Truck Cranes	Front End Loaders	Tracked Excavators
Temporary Sprinklers	Drilling Rig	Concrete Trucks
Forklifts	Hand and Power Tools	Pile Drivers