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Regional Integration of the Lower Tuscan Groundwater Formation into the Sacramento Valley Surface Water System Through Conjunctive Water Management

WORK PLAN

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1. EXECUTIVE SUMMARY

This is a proposal for a planning grant to develop an Integrated Regional Water Management Plan for the lands overlying the Lower Tuscan Formation aquifer system in the Sacramento Valley, including Butte County, Glenn County, Colusa County and Tehama County. The plan will integrate the Lower Tuscan Formation aquifer system into the management of regional water supplies to satisfy three objectives:

a. Improve local water supply reliability;
b. Improve Central Valley system-wide water supply reliability through participation in the emerging water transfer markets;
c. Enhance ecosystems in the rivers of the Sacramento Valley.

Water supply objective (a) will be satisfied through development of the Lower Tuscan Formation for use in areas that currently have inadequate supplies or are subject to dry-year shortages or curtailments. Objective (b) will be achieved by using groundwater from the Lower Tuscan Formation in lieu of surface water entitlements that would otherwise be used, thereby freeing surface water for transfer, or for mitigating the increased risk of water shortages that result from reservoir reoperation-based transfers. Objective (c) will be achieved by incorporating dam reoperation into a conjunctive water management scheme so as free additional surface water to enable environmental enhancements such as wetland, riparian habitat and environmental flow restoration in the Feather River and/or the Sacramento Rivers.

To achieve these water supply objectives, the partners will evaluate strategies to address the full array of risks and uncertainties that impede the full utilization of the Tuscan Formation today, especially risks to current users of the Lower Tuscan Formation groundwater system. These include geohydrologic, economic and institutional factors.

Conjunctive water management arrangements will play the key role in eliminating the risks associated with more aggressive use of the Lower Tuscan Formation. These would involve linking the groundwater system with either or all of three different reservoir systems – Oroville Reservoir (State Water Project), Shasta Reservoir (Central Valley Project), and Stony Gorge and East Park Reservoirs (Orland Unit Water Users Association).

Conjunctive use programs are comprised of an aquifer recharge and recovery component. Experience has shown that in-lieu groundwater storage through natural recharge is the preferred recharge mechanisms for aquifer systems in the Sacramento Valley and groundwater substitution is the preferred mechanism for aquifer recovery if the water is to be used out of county or out of basin. Utilizing these concepts, the configuration of the regional aquifer systems in the northern Sacramento Valley makes some interesting and unique conjunctive water management programs possible. The management program could work as follows:

The lower Tuscan Formation aquifer system crops out along the eastern margin of the Sacramento Valley from about Thermalito Afterbay north to Redding. This formation dips beneath other sediments of the Sacramento Valley and is found at a depth of about 600-900 feet below the ground surface east of the Sacramento River in Glenn and Colusa Counties. DWR postulates that most of the groundwater goes into and out of aquifer storage where the formation surfaces along the eastern margin of the valley. It is also where groundwater is at the highest elevation in the formation. This results in the lower portions of the aquifer system being pressurized to the point where groundwater levels in wells tapping this formation in Butte Basin and in eastern Glenn and Colusa County to flow in an artesian manner, or nearly so.

This geohydrology allows an aquifer management regime in which recharge occurs naturally at the eastern margin and recovery could occur at production wells in the Butte Basin and eastern basin portions of Glenn and Colusa Counties. However, practically all the water users in the potential recharge area utilize groundwater from the lower Tuscan Formation. Therefore, if the aquifer was depressurized in the deeper zones of the aquifer system due to the extraction of large volumes of groundwater from deep wells, then eventually the water would come out of storage in the recharge area, thereby reducing groundwater levels. This would result in an increased cost for lifting groundwater in the recharge area or a reduction in groundwater levels to the point where existing wells might become stranded.

This planning effort aims to address and eliminate all risks to existing groundwater users. The Lower Tuscan Formation, if integrated into California's water supply system, could provide major water supply reliability benefits. And, with perfect knowledge of the geohydrologic processes in the Lower Tuscan Formation, it would be possible to establish an extraction regime—including location, pumping rates, distance from existing wells-- that would assure maximum sustainable extractions without injury to any current user. However, it will take decades before we know enough about the aquifer dynamics to devise such a risk- free regime, and yet it would be foolish to require that the aquifer remain an underperforming asset in the interim. That this aquifer is "underperforming" is merely the opinion of the plan proponents who have a second source of water and thus have little to lose even if overdraft of the Lower Tuscan occurs. Fortunately, there is an approach that can permit more aggressive use of the Lower Tuscan Formation while we improve our understanding of how best to manage it. We can do that by providing current Lower Tuscan groundwater users a risk-free water supply alternative in the form of a supplemental surface water supply, and/or by imposing restrictions on the location, pumping rates and timing of new wells. Who will provide this "risk-free" "supplemental surface water" and pay for its transport from the Feather River. This will require siphoning past several creeks that would have to be crossed on the way to northern Butte County and southern Tehama County? Who will be restricted in the second situation listed here? Neither of these options are as trivial as presented here.

This would achieve all three of the objectives cited above. First, it would improve local water supplies and recharge the aquifer system through in-lieu recharge. The substitute surface water might be made available by DWR through operating Oroville reservoir more aggressively. Alternatively, the recharge water could come from the Bureau of Reclamation through more aggressive operations of Shasta or from the Stony Creek partnership by reoperating those storage dams. The water could also be swapped with an equivalent amount of water recovered through groundwater substitution with the SWP settlement contractors in the Butte Basin or through the Coordinated Operating Agreement (COA) with the CVP water users on the west side of the Sacramento River. The cost of providing the water and constructing the necessary facilities would be a cost element to the overall program. Where providing substitute surface water is not feasible due to lack of infrastructure, the IRWMP can still protect existing users through restrictions of new pumping that could cause well interference altogether, or indemnify the additional pumping costs, and still permit other areas of the Lower Tuscan Formation to be more fully utilized.

Second, this program would provide opportunities to benefit from water transfers through the state and federal water projects. Overall program recovery would occur through groundwater substitution from wells tapping the lower Tuscan Formation aquifer system. These wells could be operated in the Butte Basin in conjunction with the SWP or in eastern Glenn and Colusa County in conjunction with the CVP. Alternatively, they could be operated in both areas under the Coordinated Operating Agreement. The groundwater substitution would have the net effect of storing surface water behind Lake Shasta, Lake Oroville, or possibly other local reservoirs for use at a later time. This *in lieu* conjunctive use arrangement would also result in increased yield from the storage reservoirs. Third, this water then could be released as needed for environmental or water supply benefits downstream. For instance, this surplus could be managed in a sequence of uses to improve environmental flows in the Feather River and/or in the Sacramento River and then be diverted and used consumptively by state or federal water contractors.

The project could be operated to obtain additional annual yield through classic conjunctive use, or the program could be operated on a longer cycle like a classic water bank. Operational objectives will have to be firmed-up and operational studies completed for those facilities before the optimal choice or mix can be determined. .

The plan will be developed with ongoing consultations with the interested stakeholders and the active participation of the implementing agencies. For example, the plan for improvement of Feather River and/or Sacramento River flows will be developed by all of the project partners with the riparian landowners.

The existing partners for this effort include Glenn-Colusa Irrigation District, Orland Artois Water District, Orland Water Users Association, and the Natural Heritage Institute. In addition, Butte County and Western Canal Water District have indicated strong interest in this proposal and their participation in this planning effort is subject to ratification by their respective governing bodies. Tehama County has also indicated strong interest and has been invited to join this partnership. A preliminary list of potential additional partners appears below and in work activity #1. The grant will also be used to obtain the approval and implementation of the IRWMP by the Counties, the relevant water districts and groundwater management authorities, the Bureau of Reclamation, the Department of Water Resources, the U.S. Fish and Wildlife Service and the California Department of Fish and Game.

2. BACKGROUND

2.1 Description of regional agency

This sub-regional IRWMP will be developed through a planning process conducted by Glenn-Colusa Irrigation District, Orland-Artois Water District, Orland Unit Water Users Association, and the Natural Heritage Institute. As mentioned above, Butte County and Western Canal Water District have indicated strong interest in this proposal and their participation in this planning effort is subject to ratification by their respective governing bodies. Part of the criteria for determining who receives State funding is how inclusive the project appears to be. This project appears to have great support from Butte County. Who was authorized to speak for Butte County and indicated such "strong interest"? Did any of this occur at public meetings? Are there records of any private meetings? Should items of major importance to Butte County citizens be conducted with so little (or no) public knowledge? This IRWMP will also be developed with technical advice from the Northern district office of the Department of Water Resources and in consultation with the Bureau of Reclamation and the State Water Project. The support of the DWR and BoR will be key with regard to the possible redesign of CVP and SWP contracts to reallocate surface water according to new conjunctive management arrangements. The plan itself may call for a joint powers authority or a less formal structure in order to create a Regional Water Management Group for its implementation, as documented in Attachment B.

As the planning effort moves forward, it will be essential to include in the process other local entities and stakeholders that have a stake in this sub-regional water management effort due to their geographical location and physical access to the shared resource that is the Lower Tuscan Formation. Those entities include: 1) the following water districts: Richvale and Biggs West-Gridley in Butte County, Maxwell in Colusa County, and Provident and Princeton-Codora-Glenn in Glenn county; 2) the counties of Glenn, Tehama and Colusa; 3) the city of Chico, which draws most of its urban water supply from the Lower Tuscan, irrigators in the Cherokee Strip, the Rancho Esquón communities, Durham Dade Mutual Water Company, and the California Water Service Company that serves the City of Chico; 4) the relevant Resource Conservation Districts that work in the region; and 5) independent groundwater users.

One of the first items of the work plan, to be presented in greater detail below, will be to carry out a consultative process with all of the above entities to introduce the proposed concept for an IRWMP around the use of the Lower Tuscan Formation. This process will establish periodic updating of the entities on the analytical work conducted as part of the planning process, and will seek their ongoing feedback about these results and any additional directions of inquiry needed to address any concerns those stakeholders might have. As the IRWMP takes shape, the objective will be to persuade as many entities as possible to become signatories and partners to the plan, in order to achieve a truly consensus-based IRWMP with the best chances for successful implementation.

This is a regional planning effort, involving water managers and jurisdictions on both the western and eastern side of the Sacramento River. The Lower Tuscan IRWMP will be implemented in coordination with and with support from the three other IRWMP's in the Sacramento River Hydrologic Region for which applications for Proposition 50 planning grants have been submitted. These applications include:

- An Integrated Water Management Plan for the Sacramento Region
- Yolo County IRWMP
- Yuba County IRWMP

The Sacramento River Hydrologic Region is a large and diverse landscape that drains 22 million acre-feet of water from over 27,000 square miles of land. The Sacramento Region provides water for more than 2 million acres of farmland (22% of the State's farmland) and serves as a drinking water source for 20 million people. The Sacramento Region also provides habitat for 50% of the threatened and endangered species in California and its seasonal and permanent wetlands provide for 65% of the North American Waterfowl Management Plan Central Valley habitat objective of 7.2 million birds.

Recognizing the diverse and important geography, the four inter-related planning grant applications taken together will build upon the existing planning in the Sacramento Region to form the "Integrated Regional Water Management Plan for the Sacramento Region." This will serve as a super-regional planning process that is consistent with the Department of Water Resources' Bulletin 160 (California Water Plan) and the State Water Resources Control Board Strategic Plan, its Watershed Management Initiative and the basin planning process. The Sacramento Region IRWMP is a grass root planning process that will help implement the State's strategy to place "more emphasis on integrated regional water management" by building upon regional level water management strategies and then integrating these strategies into a coherent super-regional water management plan.

Nested within the IRWMP for the Sacramento Region are regional integrated planning efforts that are more focused, locally driven, and provide the opportunity for more detailed plans. These are complementary rather than competing proposals that will be knit together by the umbrella Sacramento Region IRWMP. Each of the regional plans will produce an integrated regional water management plan with independent utility, yet the ultimate value comes from the combined benefits of the regional plan that will be larger than the sum of the parts.

2.2 Description of region

The region to be included in the integrated plan is comprised of all of the lands overlying the Lower Tuscan Groundwater Formation within Butte, Glenn, Colusa and Tehama counties whose access to this groundwater could be hydrologically affected by development of the aquifer system at any location. Why have the vast majority of citizens in these counties who are dependent solely on groundwater not been included in this process? The planning region also includes the Feather River channel and riparian lands from Oroville Dam to the Sutter-Yuba county line in Butte County, and/or the Sacramento River channel and riparian lands downstream of Shasta Dam, with benefits that will flow all the way into the Delta, thus satisfying key Cal-Fed Bay-Delta objectives.

Please see the following maps, attached:
Attachment 3a - Lower Tuscan Map 1: Project Area
Attachment 3b - Lower Tuscan Map 2: Sub-basins in the Project Area

2.2.1 Economic and social characteristics of the region

The main economic activity in the region is agriculture, which contributes the largest share to regional output followed by manufacturing. The service and government sectors of the economy are also significant contributors to regional output. Rice has become the region's principal crop, followed by orchard crops, especially almonds, but also walnuts, deciduous tree fruits, olives, and other tree nuts. Processing tomatoes, while not large in acreage, make a significant contribution to the sector's production value. Dairy and livestock are also important commodities for the region.

The median household income (MHI) is below the statewide average in each of the three counties that comprise this region, with Glenn county at $32,107 (67.6% of statewide MHI), Butte County at $31,924 (67.2% of statewide MHI), and Colusa County at $35,062 (73.8% of statewide MHI). The predominance of the agricultural industry in the region and its reliance on part-time and seasonal employment has contributed to a high unemployment rate and surplus labor condition for the region.[1] Regional unemployment for the period 1998-2002 averaged 14.7%. Over the same period, statewide unemployment averaged 5.6%.

2.2.2 Water Quantity, quality, hydrogeologic characteristics and water related infrastructure

Water availability in the region generally exceeds current total requirements in average conditions. CVP water service contractors within the Tehama-Colusa Canal Authority (TCCA) may experience some decrease in available supply in average years, but generally are able to meet the majority of requirements in such years. In critically dry conditions (years when the Sacramento River Settlement Contractors' [SRSCs] supply is reduced by 25 percent and water service contractors' supplies are further reduced [historical maximum has been 65-percent reduction]), requirements are projected to be deficient. Opportunities exist through transfers (e.g., CVP water and Forbearance Agreement) or other means for SRSCs to assist in years when water service contractors' (both north and south of the Delta) CVP contract quantities are reduced and SRSC receive full supplies[2].

The groundwater hydrology of the Sacramento Valley is not fully understood. It is not really a single large groundwater basin filled with a heterogeneous mixture of saturated sand and clay. Current work by the Department of Water Resources and others has revealed that, in fact, the northern Sacramento and southern Sacramento Valleys are quite distinct from each other on the bases of aquifer geometry, geology, and hydrology. In the northern Sacramento Valley, four regional aquifer systems exists(sic). Three of the four – the shallow alluvial aquifer system, the Tehama Formation aquifer system, and Upper Tuscan Formation aquifer system -- meet most of the agricultural and municipal groundwater supplies in the region, while the third, the Lower Tuscan Formation aquifer system, remains relatively unutilized. Perhaps the Lower Tuscan has been underutilized in Glenn County where it is so deep, but in Butte County almost all the orchards and citizens of the City of Chico get their water from that layer of the aquifer. All four aquifer systems behave somewhat independent of each other. Total groundwater resources in the region amount to approximately 70 million acre-feet, of which roughly 30 million are contained in the Lower Tuscan formation. The quality of water in all four of the regional aquifer systems

[1] Employment Development Department, County Snapshots for Glenn and Colusa Counties, published in 2003.
[2] Short-Term Work Plan for Glenn/Colusa County, at 1 (2001).

is generally very good to excellent and there are no impaired water bodies, save a few isolated points of source pollution.

Water supply facilities that affect flow conditions on the upper Sacramento River include the Central Valley Project and local irrigation district facilities. The most significant of these facilities is Shasta Dam, with a storage capacity of 4,552,000 acre-feet. State Water facilities in the region include Lake Oroville, with a capacity of 3.5 million acre-feet, and the Thermalito Afterbay. Other major reservoirs in the region include Black Butte, East Park and Stony Gorge Reservoir on Stony Creek.

The Lower Tuscan Formation, which is associated with deposits from the Cascade Province volcanoes, outcrops in the foothills to the east of Butte County and Tehama County and dips and thins towards the west. In the western Sacramento Valley, the formation is encountered at a depth of approximately 800 feet. The recharge zone for the formation is associated with the foothill outcrops and a confined pressure surface gently mimics the westward dip of the formation. The piezometric surface in wells penetrating the Lower Tuscan on the west side of the Sacramento Valley rises to within approximately 30 feet of the ground surface. While its geometry is not known with precision, the Tuscan Formation appears to extend nearly across the northern Sacramento Valley to the west and from Redding to the Sutter Buttes in a north-south direction. Its hydraulic properties are not well characterized, nor are the potential impacts of increased development down gradient of the recharge zone. This bothers us, even if it doesn't seem to bother GCID. That may be because we live "up gradient" and will be permanently affected long before the Partners benefiting from this plan have any lack of water. Developing a fuller understanding of these issues is the focus of ongoing technical analysis being undertaken by water management entities in the Sacramento Valley region, as listed in the section on data and technical needs, below.

Notwithstanding the uncertainties as to the surface boundaries of the overlying lands, the groundwater users that could potentially be affected by further use of the Lower Tuscan Formation are readily ascertainable and well known.

2.2.3 Advantages of regional management

The justification and advantages of a regional management of this regional resource lie in the fact that the Lower Tuscan Formation is a common property resource to which all overlying landowners and their water management entities have correlative rights. If the Lower Tuscan Formation is to realize its potential to advance any or all of the stated objectives—to increase the reliability of local water supplies, to enhance water marketing opportunities, and to enable environmental flow improvements—it must be managed sustainably. That can only be done by managing the resource such that the risks of more aggressive utilization are identified and eliminated by the beneficiaries. In turn, this can only be accomplished on a regional (aquifer-wide basis).

The resulting integrated management plan will complement other regional planning efforts organized by water users based on their source of surface water supply, e.g., State Water Project and US Bureau of Reclamation contractors, or according to political boundaries, or on the basis of the Sacramento Valley as a whole (e.g., the Northern California Water Association). While each of these groupings has its own strengths, the proposed planning effort seeks to achieve an optimal, locally relevant management configuration that will focus specifically on the underlying

shared hydrogeology of the sub-region. At the same time, this effort will actively coordinate with the Valley-wide integrated planning endeavor, so that integrated regional water planning will occur both at the local sub-regional level as well as at the basin-wide level in a collaborative manner.

The Lower Tuscan Formation aquifer system extends nearly across the northern Sacramento Valley and underlies the service areas of several CVP and SWP water contracting districts. There is a unique opportunity for local CVP and SWP water users to utilize this common resource in concert with State and Federal projects to achieve the three goals of the proposed IRWMP, while also providing additional flexibility for SWP and CVP operations.

These benefits can only be realized through a regional water management program that fosters cooperation and coordination between the CVP, SWP, and other local surface water suppliers in conjunction with the local water users that overlie the Lower Tuscan Formation aquifer system. Implementing a regional water management plan that does not incorporate all of these factors will significantly diminish the potential yield of the program. Although technically and politically it makes sense to manage the lower Tuscan Formation aquifer system at the local level, there is nothing to preclude this water management building block from being incorporated in a larger more system-wide water management strategy at some time in the future. What a concept! Let's plan on turning our future and economy over to people in the large population centers where voters wouldn't care if everyone in Northern California dried up and blew away!

2.2.4. Environmental features of the region

The many rivers and streams that are tributary to the Sacramento River provide important riparian habitat that is critical for many aquatic and terrestrial species including the spring-run Chinook salmon, winter-run Chinook salmon and Central Valley steelhead. This region is the only known area for the winter-run Chinook. The valley floor region section adjoining the river provides some of the most important wintering areas along the Pacific Flyway for many varieties of waterfowl. The region also houses several wetland and waterfowl preserves that provide nesting and migration areas for threatened avian species including the bald eagle and Swainson's hawk and numerous species of neotropical birds. All of these valuable resources are vital components of the ecosystem and contribute to the ecological health of the entire state. The Sacramento River Hydrologic Region also encompasses all or a portion of six of the state's 18 national forests[3].

There are no Marine Protected areas in Butte, Colusa, or Glenn Counties, which are all inland counties. Butte County contains the following Ecological Reserves: Butte Creek Canyon; Butte Creek House; and North Table Mountain. Ecological Reserves are managed by California DFG and provide critical habitat for threatened or endangered species or species of special concern. California DFG also manages Wildlife Areas for the protection and enhancement of wildlife, including threatened and endangered species, and plant habitats, and to provide the public with related recreational uses. The following Wildlife Areas are found in Butte County: Coon Hollow; Gray Lodge; and Oroville. The Upper Butte Basin Wildlife Area is found in Butte and Glenn Counties. The Sacramento River Wildlife Area is present in Butte, Glenn, and Colusa Counties. The Colusa Bypass Wildlife Area is in Colusa County.

[3] DWR, Bulletin 160-05, at 6-1 (2005).

In the Sacramento Valley, over half of the existing 67,500 acres of wetlands are managed as seasonally flooded tule marsh (wetlands with significant amounts of tall, dense emergent cover), while about 40 percent of the acreage is managed as seasonally flooded moist-soil vegetation (wetlands dominated by short-statured, seed producing annual plants). WA's and NWR's are intensively managed for waterfowl, and habitat conditions are generally good to excellent although funding is often inadequate for optimal enhancement. During dry years, water in quantities required for optimum habitat conditions on public areas is generally not available after January 1[4].

2.3 Planning objectives

The resulting IRWMP will have three overarching objectives:

a. **Improve local water supply reliability**. Much of the area overlying the Lower Tuscan Formation is developed for irrigated agriculture. Some areas are irrigated with groundwater only and other areas with a combination of groundwater and surface water. Particularly within the Tehama-Colusa Canal service area in Glenn and Colusa Counties, where supplemental surface water supplies are projected to decline (due to tiered pricing and other federal policies) and ultimate irrigation demands are yet to be realized, additional water is needed to avoid overdrafting the Tehama Formation via private pumping. The Lower Tuscan Formation is viewed as a potential source of this additional water. Also, purveyors such as GCID and the OUWUA that enjoy reliable surface water supplies are subject to shortages in critically dry years. In these areas, the Lower Tuscan is viewed as a potential source to fill occasional water supply shortages.

b. **Improve system-wide water supply reliability** through participation in the emerging water transfer markets. Each of the Partners is facing some combination of high water cost, the need to invest substantially in capital improvements to enlarge water supplies and the need to address rehabilitation and modernization of aging irrigation infrastructure. At the same time, Sacramento Valley farmers are faced with the most competitive market forces ever, squeezing profits and reducing the ability to bear the costs mentioned above. In many cases, water transfers will play an important role in bridging a significant gap between revenues and costs. The Sacramento Valley farmers who will be transferring water to bridge the gap between revenues and costs are the Partners in putting this plan together. They are raising rice. There is nothing here for the Sacramento Valley orchardists who are dependent solely on groundwater. The Partners plan to utilize the Lower Tuscan Formation in two ways to produce surface water for transfer. The first is by substituting Lower Tuscan Formation pumping for surface supplies that the Partners would otherwise be entitled to use (groundwater-substitution-based transfers); the second is by using Lower Tuscan Formation pumping to mitigate water supply shortages that occasionally result from reservoir re-operation. For example, the OUWUA is investigating reoperation of Orland Project Reservoirs. In all but the very driest years, additional reservoir releases made one year will be refilled with high flows in the subsequent year, thereby producing new yield. In some years, however, is possible that reservoirs do not completely refill, causing a water supply shortage. Lower Tuscan Formation pumping is one possible means of mitigating the increased risk of shortages caused by reservoir reoperation.

[4] 1990 Central Valley Habitat Joint Venture Implementation Plan, at 64

c. **Enhance ecosystems in the rivers of the Sacramento Valley**. This will be achieved by focusing investigative and planning efforts on two possible sources of environmental improvements that could result from the yield of additional water in the system through the conjunctive management approach: increased environmental flows to benefit the Feather and/or Sacramento River and the Delta to contribute to riparian habitat and channel restoration, and improved water supply to wetlands that contain waterfowl and other valuable habitats. Nothing is mentioned about the tributaries to the Feather and Sacramento which may be dewatered as the groundwater beneath them is aggressively pumped.

These objectives were determined through consultation with and among the regional water managers, Butte County, and the Natural Heritage Institute. Each of the above-named entities has a specific set of interests in water resources management for productive and/or environmental purposes. The proposed planning effort combines these diverse interests to achieve the overarching objectives of local and statewide water supply reliability and ecosystem enhancement. The elaboration of an IRWMP allows for precisely this kind of combination of diverse objectives to achieve shared goals. As the planning process moves forward, the specific interests of other stakeholders will be worked into the IRWMP. Establishing an exhaustive listing will be an important item in the work plan, in view of an inclusive planning process.

The IRWMP will describe how the water management improvements that make feasible the further utilization of the Lower Tuscan Formation will also create flexibility in the storage and release regime at one or several of the aforementioned dams such that improved environmental flows can be released into the downstream channel for the benefit of the Feather River, lower Sacramento River, and the Delta. This environmental flow regime will be developed by the planning partners in consultation with the riparian landowners to assure that the flow changes would not entail any involuntary or uncompensated encroachments on or impacts to private lands, and with the state and federal fish and wildlife agencies to assure that the flows are designed to achieve maximum fishery and riparian ecosystem benefits within those constraints.

The proposed planning effort will meet statewide priorities in a variety of ways. Statewide priorities are set forth in the CalFed Record of Decision, the California Water Plan (Bulletin 160), the Central Valley Regional Water Quality Control Board's Watershed Management Initiative, Revised Water Rights Decision 1641. The objectives of this proposed integrated regional plan would:

- Implement recommendations of the floodplain management task force by protecting natural and economic resources and protecting water quality and supply[5]. How?

- Implement recommendations of the state species recovery plan, by improving habitat and spawning conditions for the Coho Salmon.

- Improve the operation and efficiency of dams and provide for environmental flows to benefit ecosystem restoration[6]. Not in the feeder streams.

[5] "Multi-Objective-Management Approach for Floodplains: Where feasible, projects should provide adequate protection for natural, recreational, residential, business, economic, agricultural, and cultural resources and for water quality and supply." Floodplain Management Task Force Report, at 12.

- Address environmental justice concerns by improving water supply reliability to rural areas.[7] Rural areas may not have reliable water systems because the population is too spread out to make infrastructure cost effective. Exactly how will this plan improve water supplies to disadvantaged rural communities?

- Achieve the goals of the CalFed Bay-Delta Program to improve the reliability for water users while also prioritizing the needs of fish and wildlife[8].

- Implement the two goals of the RWQCB Watershed Management Initiative to enhance ecosystems in the Sacramento Valley while improving system wide water supply reliability through the use of water transfers.[9]

- Assist in meeting Delta Water Quality Objectives through water transfers and environmental flow releases from reservoir storage.[10]

- Implement the recommendations from the DWR 2005 Draft Water Plan (Bulleting 160) by improving the operation and efficiency of one or more surface water reservoirs in the Sacramento Valley, and by providing for environmental flows in the Feather and/or Sacramento Rivers to restore aquatic ecosystems.[11]

- The IRWMP will improve local and system wide water supply reliability, while enhancing ecosystems and species habitat. This coordinated approach will reduce conflict between water users. Unlikely, because all the water users have not been consulted or considered.

2.4 Integration of water management strategies

The Tuscan IRWM Plan will integrate the following water management strategies:

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[6] Recommendations from the DWR 2005 Draft Water Plan: (1) "reoperate water facilities to improve their operation and efficiency"; (2) "facilitate environmentally, economically, and socially sound transfers to avoid regional shortages"; and (3) "integrate ecosystem restoration with water planning and land use planning." Draft Water Plan, at 7-8.

[7] "[I]t is important to examine the potential effects of water management reforms on rural communities and the public health and financial impacts of ERP and Water Quality Program actions on the large numbers of minorities and disadvantaged people living in urban as well as rural areas." CalFed R.O.D., at 32.

[8] "One of the primary goals of CALFED is to improve the reliability of California's water supply within the context of unpredictable hydrology and the competing needs of fish and wildlife and water users." CalFed R.O.D., at 40

[9] The two goals of the Watershed Management Initiative are to: (1) "preserve, enhance and restore water resources while balancing economic and environmental impacts"; and (2) "encourage balanced and efficient use of water through water transfers, recycling and conservation." SWRCB, Watershed Management Initiative, at 3 (2001).

[10] Revised Water Rights Decision 1641 indicates that water transfers are a preferable tool for mitigating water quality impacts from groundwater withdrawal and land use impacts, among other impacts in the Delta. Revised Decision 1641, at 94-95 (2000)

[11] Recommendations from the DWR 2005 Draft Water Plan include: (1) "reoperate water facilities to improve their operation and efficiency"; (2) "facilitate environmentally, economically, and socially sound transfers to avoid regional shortages"; and (3) "integrate ecosystem restoration with water planning and land use planning." Draft Water Plan, at 7-8.

- Groundwater management
- Water supply reliability
- Conjunctive use
- Water transfers
- Ecosystem restoration
- Environmental and habitat protection and improvement
- Flood management
- Recreation and public access
- Water conservation
- Wetlands enhancement and creation

Groundwater management, water supply reliability, and environmental and riverine and wetland habitat protection and improvement are explicit objectives of the proposed IRWMP, in addition to being actual strategies. Below, we discuss in detail how these objectives might be successfully attained through the integration of conjunctive water management, water transfers and reservoir reoperation. This program will incidentally improve flood management and provide recreational amenities. Water conservation is the natural and expected consequence of market incentives. As the planning effort goes forward, all of these strategies will be actively incorporated into the plan, so that it may successfully meet IRWM Plan Standards, pursuant to CWC §§ 79562.5 and 79564.

Tests conducted by the Department of Water Resources indicate that the Lower Tuscan Formation is isolated from the other regional aquifer systems, including the alluvial aquifer system, and can therefore be utilized without impacting the domestic groundwater users. In addition, knowledgeable experts believe there is virtually no communication between the Lower Tuscan Formation aquifer system and the Sacramento River. What tests? What experts? What about the communication between the Lower Tuscan Formation and the aquifers above it? Does anyone know of domestic wells that falter when the surrounding orchards are irrigated? Please let us know. Thus, the key technical question is how much groundwater development the Lower Tuscan Formation could support without affecting the water levels of the wells that currently pump the Lower Tuscan Formation, including groundwater users in the Cherokee Strip, Rancho Esquón, Durham Mutual Water Company, the California Water Service Company that serves the City of Chico, and other existing groundwater users of the Lower Tuscan Formation. These users pump about 70,000 acre-feet per year (referred to hereafter as the "existing groundwater users"). 70,000 acre-feet per year is not creditable, Cal Water pumps 36,000 acre feet for the citizens of Chico alone. There are approximately 50,000 acres of almonds on wells in Butte County. At 2-3 acre feet per acre per year that would equal an additional 100,000 to 150,000 acre feet. Then, there are walnuts, domestic wells on the eastern edge, etc. This might actually be more like 150,000 to 200,000 acre feet. Butte County has rights to 27,500 acre feet they could sell to Cal Water, but that is not enough to meet Chico's requirement.
This is a technical issue that will likely take many years to resolve. This is not merely a technical issue, it is central to the scientific honesty of the project and a test of the professed interest on the part of the Partners in not harming their neighbors.

For integrated regional water management that includes more aggressive utilization of the Lower Tuscan Formation to move forward in the interim, it is necessary to develop a plan that effectively combines diverse water strategies while eliminating the water supply risks to these existing groundwater users. This issue becomes more significant under a maximal conjunctive

use scenario, in which the Lower Tuscan Formation is used as a regional water bank that is drawn upon during below normal and dry years to substitute for surface water deliveries from the Feather River (by Western Canal, Richvale and Biggs West Gridley, which enjoy surface water entitlements of around 1 million acre feet) and from the Sacramento (by GCID, Providence, Princeton Codora Glenn, and Maxwell Districts which also have approximately one million acre feet of surface water entitlements).

There are many ways to mitigate the risks to current users of the Lower Tuscan Formation as this water source is developed. One option would be to defray any increased groundwater lifting costs associated with a fluctuating groundwater table. Another example of a possible configuration would provide a physical solution to the geohydrologic risks for the existing groundwater users by providing them a substitute water supply out of Lake Oroville amounting approximately ~~70,000~~ 150,000-200,000 acre feet per year, which is the amount of water needed to replace existing groundwater usage in the recharge area. This would, in effect, make existing groundwater users independent from the Lower Tuscan Formation aquifer system. Moreover, in dry or below normal years, when the Lower Tuscan Formation might be more heavily exploited for groundwater substitution exports by the Feather River and Sacramento River surface water users, an additional 70,000 acre feet of groundwater would be left in the Lower Tuscan formation.

This could be accomplished by constructing an unlined canal from Thermalito Afterbay or Forebay to the recharge area and providing growers and municipalities in this area with a surface water supply. The unlined canal used to make these deliveries would also act as a direct recharge source. Water would have to be pumped as far north as Deer Creek in Tehama County, how much would it cost to siphon Lake Oroville water over Butte Creek, Big Chico Creek, and all the other creeks. The idea of doing this with an unlined canal is problematic. There is also the cost of the dispersal system, and the annual cost of pumping. Several other conveyance options also exist. Because they now would be on surface water, response of the aquifer system to program recovery stresses would not be problematic and in fact would be transparent to the water users.

Drawing down Lake Oroville by an additional ~~70,000~~ 150,000-200,000acre feet per year would increase the flood retention capacity of that reservoir by an equivalent amount. In years in which the runoff is sufficient to make up that deficit, the ability of Oroville to meet its current level of water supply and environmental flow release obligations would be unaffected. In years when the refill is insufficient to fill all of the ~~70,000~~ 150,000-200,000acre feet gap, the Lower Tuscan Formation would be tapped (though a groundwater substitution arrangement) to make up the difference. Under this reoperation scenario, a portion of the water that would otherwise be released in an uncontrolled pulse for flood control purposes is now captured. This represents new yield in the system. This is water that can be used to augment spring releases into the Feather River to create a periodic environmental flow above and beyond current requirements for habitat and channel restoration purposes in the Feather River and into the Sacramento-San Joaquin Delta. That is the environmental restoration payoff of this scenario. Ideally, this increased flow can be captured at the export pumps after it has served its environmental restoration purpose, thus improving system-wide supply reliability.

Another scenario to be considered involves an in-lieu recharge strategy combining the objectives of environmentally sound aquatic rice straw decomposition and waterfowl flood-up with that of increased water reliability to meet local and system-wide needs. Historically, rice straw removal

has been accomplished by burning the rice fields. Due to changing air quality regulations, the transition from burning to aquatic decomposition of rice straw has resulted in an increased demand for water from the SWP and CVP during the fall. For example, water districts in the Butte Basin have historically taken about 50,000 acre-feet of fall water from the Feather River system for waterfowl habitat. However, in recent years the fall water use has increased to about 200,000 acre-feet, to accommodate aquatic rice straw decomposition. It is projected that fall water demand could reach 300,000 af in the near future. If groundwater from the Lower Tuscan Formation were used instead to accommodate water needs for waterfowl flood-up and rice straw decomposition, an additional 200,000 to 300,000 af of surface water could be made available through the SWP and CVP to meet other local and system-wide needs. Moreover, the reoperation of Oroville and/or Shasta reservoirs to accommodate this scenario could be done at times other than the fall, such as the summer when irrigation needs are highest. Such a conjunctive management strategy has the potential to help manage this increase in fall water demand, while helping reduce air pollution caused by rice-straw burning.

These are only a few among several alternatives that might emerge in the planning process. Like these, the other alternatives considered will be those that can provide mutual benefits to water managers, groundwater users and the environment, a classic win-win-win water management improvement. The alternatives could involve the reoperation of the Orland Unit Water Users Association system or Shasta Reservoir, instead of, or in addition to, the above scheme involving the Lake Oroville. These alternatives could generate environmental flow benefits to the Sacramento River and/or to the Feather River. Thus, all alternatives must demonstrate that they can deal successfully with the risks to the existing groundwater users that could be associated with aggressive use of the Lower Tuscan Formation as a water supply and a groundwater bank, and with improved environmental flows in the Feather River. In addition, potential risks to other parties, such as existing agricultural users, third parties, environmental interests, and the physical environment must also be clearly identified and addressed from the outset of this planning endeavor. A discussion of risks to stakeholders and how they will be addressed is presented in section 2.6.2, below.

2.5 Plan implementation

Three phases of activity are contemplated in this proposal:

1. The development of an Integrated Regional Water Management Plan to integrate the Lower Tuscan Formation into the water supply resources of the region. This will be done through technical investigations and design of risk management strategies and institutional agreements by the partnership. These strategies and agreements will be designed with input from interested stakeholder communities. The plan will include a detailed implementation strategy, clearly assigning implementation responsibilities, determining implementation schedules and defining a monitoring process to ensure that the plan is appropriately executed. The implementation of the IRWMP is anticipated to occur under a flexible, adaptive management approach that will continuously reflect the feedback of stakeholders and adjust activities to reflect lessons learned from ongoing results. This will provide for a long term implementation horizon.

2. Achieving adoption of the plan by the governmental entities that would be involved in its implementation. These include: the Counties, the relevant water districts and groundwater management authorities, the Bureau of Reclamation, the Department of

Water Resources, the U.S. Fish and Wildlife Service and the California Department of Fish and Game. CEQA and NEPA compliance will be a part of the approval process. However, the implementation of the IRWMP (and therefore its adoption) are likely to be exempt from the requirement to file an EIS/EIR because the plan will be designed to not only avoid creating significant environmental impacts in pursuing the water supply objectives but actually to restore and enhance the environment through improved environmental flows. This document only talks about increasing flows in the Feather and the Sacramento, what about stream seepage from the Chico, Big Chico, Butte, Deer, Rock and Mud Creeks and the implications for the riparian habitat along those streams and the fish that spawn in them? In any event, the plan itself will include impact analysis, comparative evaluation of alternatives and impact mitigation strategies. As such, it will satisfy the EIS/EIR requisites.

3. Creation of the legal framework that will allow the implementation of the adopted Plan. This could consist of a joint powers authority, a special legislation management district, or a memorandum of understanding.

2.6 Impacts and benefits

The proposed planning effort will include a) a technical investigation into the potential benefits and impacts of various scenarios for integrating the Lower Tuscan Formation, an identification of the risks—hydrologic, economic, legal, institutional—associated with each scenario, b) a strategy for eliminating or managing such risks, and c) a recommendation for a course of action that will satisfy the water management objectives described above in an manner that is acceptable to all stakeholder interests.

2.6.1 Projected Benefits

The major benefits of developing the proposed plan correspond to its objectives: 1) increased water reliability locally for users in the region; Only for owners of surface water rights 2) increased water reliability at the statewide level; This can only encourage the rest of the state to consider the Sacramento hydrologic region to be the cheap alternative to developing regional sustainability with desal, conservation, recycling, groundwater banking, etc. All these are calculated in the State water plan to more than meet future requirements without putting our environment at risk. and 3) improved environmental flows in the Feather and/or Sacramento river and/or associated riparian floodplains and wetlands. See above, nothing for the other streams that support our environment.

Additional benefits anticipated from the implementation of the proposed IRWMP include the following:

- Avoidance of costs to irrigators and domestic users due to water shortages; decreasing costs to rice growers at the expense of orchardists
- Increased revenues from water transfers to holders of water rights;
- Better management of current increased water demand in the fall due to needs for the aquatic decomposition of rice straw. The additional yield resulting from conjunctive water management could decrease costs of rice straw decomposition to growers;

- Increased revenues to rice cultivators due to improved water temperatures as groundwater is substituted for surface water; It is counterintuitive that groundwater is warmer than surface water, that may be true in geothermal conditions, but where does that occur within the confines of this plan and does that occur where pumping is planned?
- Improved inflow conditions into the Bay Delta;
- Additional permanent water supply for the Environmental Water Account;
- Improved opportunities for boating and tourism due to environmental enhancements. Not in the reservoirs!

All of these benefits are anticipated by the Partners, not the farmers who are dependent on groundwater. What may seem beneficial to holders of surface water rights growing rice is NOT necessarily a benefit to their neighbors.

2.6.2 Impacts and Risks

Implementation of an integrated regional water management plan for the Lower Tuscan Formation aquifer system will involve some level of risk for stakeholders in the region, and possibly to the physical environment itself. The planning effort will require a thorough inventory of stakeholders, of the interests they seek to protect, and an assessment of the impacts and risks they may face in this endeavor.

Much of the risk perceived may be primarily the result of our current level of, or lack of, knowledge about the hydrogeology of the region. As the level of knowledge about this resource increases, the potential risk factors can be eliminated or mitigated. This planning effort seeks to develop an inclusive stakeholder consultation process that will allow all perceived and real risk to be appropriately evaluated and proactively mitigated or eliminated.

The risks can be broadly grouped into the following categories:

- Third party risks
- Environmental risks
- Agricultural risks
- Physical system risks

Third party impacts are impacts to stakeholders that are not directly participating in the program. These impacts may include such items as the increased cost to irrigate crops because of a water management activity. Experience has shown that these impacts can either be real or perceived, and must be apprehended in the political arena as much as in the technical arena. In a rural agricultural setting, which encompasses most of the northern Sacramento Valley, individual growers seek to protect their access to the groundwater supply. Their livelihood is dependant on having an adequate and affordable supply of groundwater to meet crop water requirements at all times. Because of this, a regional water management strategy may cause distrust among local growers who feel that participation in such a program will result in their loss of control over the resource. Local growers also remember the third party impacts that occurred during past water transfers, whether these impacts were **real or perceived** . (emphasis added) This is a fairly arrogant statement!!! A well reasoned and implemented regional water management strategy could include components that would increase the state-wide dry year water supply reliability, while at the same time enhancing local water supplies and reducing irrigation costs for growers.

These risks can be managed by an integrated regional monitoring and reporting program and through adaptive management elements incorporated into the overall regional water management program. Some of these risks could also be eliminated through development of supplemental water supplies or redirecting existing supplies. The one key risk factor, public acceptance, might best be managed by public outreach and involvement in the program development and an aggressive public relations program to explain the program and its potential benefits to the locals. Are these the same "locals" who only imagined they had a problem when they didn't have water during past water transfers?

Another potential risk factor is inadvertent environmental impacts. The buried portions of the lower Tuscan Formation aquifer system are confined and isolated from the Sacramento River, therefore operating a regional water management program in the north valley should not directly impact flows in the river. But operation of such a program might impact streams on the eastern margin of the northern Sacramento Valley where the formation crops out at the surface. Some of these streams support listed species of salmon. In addition, there is a potential that there might be impacts to trees and other vegetation on the northeastern margin of the valley as a result of larger than historical swings in groundwater levels. These risks could be managed through an environmental monitoring program and coordinating and integrating the monitoring program into the overall regional water management strategy. These risks might also be managed by enhancing flow in these streams to compensate for any program related seepage losses. This could be accomplished by adjusting diversions to and from these streams in the upper watershed. What diversions on what streams?

Another risk factor is the potential impact to the agricultural community. This risk arises from the possible change in irrigation source water that might occur as part of the overall water management strategy. Utilizing surface water on crops such as almonds, that historically have used groundwater, can carry certain diseases, while using groundwater on crops that have historically used surface water, such as rice, can cause algae problems known as scum. So there is a potential risk to growers as a result of participating in a regional water management program in the form of potential reduced crop yield. These risks can be minimized through advances in irrigation technology for tree crops (the problem of phytophera and bacteria build up in the sprinkler pipes as a result of warm surface water possibly can be treated with slugs of chlorine, but what happens to all that chlorine, especially on land that has a confining layer of "hardpan" not very far below the soil surface? and through improved chemical treatments for rice More chemicals? What is the ultimate fate of these chemicals in the environment?. Additional research is needed to resolve these potential risks. Moreover, these risks may be mitigated by counterbalancing factors such as the fact that rice may benefit from being irrigated with groundwater rather than surface water due to temperature considerations. This in turn may lead to increase yields in rice production resulting from a new water management strategy. What about decreased yields in the almonds? And walnuts?

One final risk factor that must be managed during development of a regional water management program is potential impacts to the aquifer system itself. The buried portions of the lower Tuscan Formation aquifer system are only now starting to be utilized. Little is known about how the aquifer system will behave if it is more fully exercised. As development of this resource continues to increase there will be changes in the effective stress experienced by the aquifer system and potential changes in the groundwater gradient magnitude and direction. This has the potential to initiate land subsidence or cause the mobilization of poor quality water into the

aquifer system. Land subsidence has the potential for reducing the freeboard on levee systems, thereby reducing their safety factor during high water events. Because the Tuscan Formation is underlain by sedimentary rock that contains saline water there is a risk of poor quality water could migrating upward if the resource is over utilized. At last, a realistic inventory of some of the problems. Management of these risks could be achieved by integrating an adaptive management strategy with the comprehensive groundwater level, groundwater quality, and land subsidence monitoring programs that already form a part of Butte and Glenn County ordinances, respectively. The existence of such ordinance further strengthens the potential for integration among the planning and water management entities in the region. Thus, such a risk management and monitoring program will be integrated into the overall regional water management program.

A preliminary inventory of these and other risk factors, the corresponding risk management strategy proposed, and the planning agenda for each are summarized in Table 1:

Table 1. Risk Management and Knowledge Requirements

Nature of Risk	Risk Management Strategy	Knowledge Requirements
Physical System and Third Party Risks		
Well stranding problem for existing groundwater users of the Lower Tuscan Formation .	Provide substitute surface water supply.	Financial analysis of providing surface water and infrastructure.
Over utilization of the Lower Tuscan jeopardizing its long-term use.	Determine yield and establish clear and conservative pumping limits.	Determine "no net long term depletion" yield and recharge characteristics of the Lower Tuscan Formation.
Interaction between LTF system and the overlying Upper Tuscan Formation , Tehama Formation, and alluvial aquifer systems.	Monitoring and adaptive management strategy.	Extent of interaction between Lower Tuscan and aquifers above.
Environmental and Agricultural Risks		
Involuntary encroachment of river flows due to increased environmental water releases.	Flow restoration scenarios that cause such encroachment will not be implemented absent voluntary compensation schemes.	Detailed modeling of flow restoration scenarios and their impacts on riparian lands.
Involuntary encroachment of river channel due to increased environmental water releases.	Flow restoration scenarios that cause such encroachment will not be implemented absent voluntary compensation schemes.	Detailed modeling of flow restoration scenarios and their impacts on riparian lands.
Adverse effects on wetlands from increased pumping.	Define zone of vulnerability and locate extraction wells to avoid interference.	Modeling of extraction rates and locations and effects on wetlands.
Adverse effects on salmon and/or vegetation due to changes in stream and river flows.	Project goals includes improvement of fishing flows and temperatures and riparian ecosystems. Inadvertent impacts would be mitigated through monitoring and adaptive planning.	Detailed modeling of flow restoration scenarios and their impacts on aquatic and riparian habitats.
Risk of diseases and scum from using surface water on crops traditionally irrigated from groundwater and vice-versa	Improved irrigation technology and chemical treatment	Crop protection strategies under new irrigation conditions and technical means to remediate.
Other Economic Risks		
Increase in the price of water for local users as demand for it increases statewide.	Determine "no net long term depletion" yield and establish clear and conservative pumping limits on new yield; establish fair pricing mechanisms.	"No net long term depletion" yield and recharge characteristics of the Lower Tuscan Formation.
Effects of increased water transfers on local economy (Third party issues).	Define "no net long term depletion" yield and establish clear and conservative pumping limits.	"No net long term depletion" yield and recharge characteristics of the LTF; economic linkages within local economy related to water use and mgt.
Depressurization of Lower Tuscan leading to increased lifting costs to existing and new users.	Maintain groundwater levels at "no net long term depletion" yield as a long term average.	"No net long term depletion" yield and recharge characteristics of the LTF;
Institutional and Legal Risks		
Loss of control over in-basin water resources through export contracts.	All contracts subject to firm time limits.	Permitting authorities of the various counties.
Opposition from environmental groups opposing water transfers, or by other stakeholders who feel their interests may be threatened.	Early and frequent consultation and information dissemination. Rely on physical criteria and county basin management objectives in the export control ordinances.	Detailed inventory of stakeholders and of their respective interests.

Compliance with CEQA will consist of seeking a categorical waiver by making the IRWMP functionally equivalent and by reducing the environmental risks to the point where a finding of no significant impact is warranted. However, should a CEQA review be required, that will be conducted as part of the adoption process by the responsible agencies.

2.7 Data and technical analysis

The proposed planning will rely both on existing and new data. Extensive data have been or are being collected throughout the region relating to groundwater and surface water management. However, new data will need to be generated to address remaining gaps in knowledge.

The technical research activities recently completed or currently underway in the Northern Sacramento Valley that will inform this planning effort include the following:

- Basin Hydrogeologic Investigation - Review of existing water well drillers reports and electric logs to develop geologic cross sections of the Sacramento Valley. Drill and install nested dedicated monitoring wells to obtain representative water levels and water quality samples. DWR

- Basin Hydrology Investigation - These activities include constructing test production wells and conducting aquifer performance tests to measure aquifer properties (e.g. transmissivity, storage, and leakage). DWR and Glenn County

- Nuclear Chemistry Investigation - Sample dedicated monitoring wells and measure isotope ratios of selected elements and compounds. This data provides recharge source water identification and helps age date groundwater in storage. DWR and LLNL Lawrence Livermore National Laboratory's study of the Lower Tuscan water determined that the groundwater "age" (the amount of time since the water entered the aquifer system) varied from 100 years along the eastern margin of the valley to 52,000 in the aquifer underlying Glenn County. This begs the question, will we be mining groundwater in an unsustainable way if we pump out 52,000 year old water with no idea of how long will it take for new water to enter and flow through the system. This is like managing a trust fund while ignoring the income. That would be irresponsible in trust management, it is irresponsible in water management.

- General Water Quality Investigation – Sample dedicated monitoring wells and analyze samples for general water chemistry. This investigation provides baseline water quality information in the various aquifer systems and determines water types in each. DWR and USGS

- Groundwater Modeling – Develop IGSM models for the Butte Basin and eastern Glenn County. - Butte County, SCFP, and USGS

- Land Subsidence Investigation - Install and maintain a network of extensometers to measure point land subsidence and determine ground response to various aquifer stresses. Maintain a GPS monument grid to measure area land subsidence. DWR, Glenn County, Butte County, SCFP.

The planning grant would be used to address the following remaining questions, among others:

1. How much can Sacramento Valley CVP surface water diversions be safely offset by groundwater pumping from the lower Tuscan?
2. What are the recharge characteristics of the Lower Tuscan Formation? See project budget numbers. The Partners plan on spending only $12,000 to answer this question.
3. What are the relative costs of pumping from the lower Tuscan as opposed to taking delivery of CVP surface water?
4. What are the necessary institutional arrangements that would be needed to implement a regional plan for managing the Lower Tuscan Formation in coordination with the operation of Oroville or other dams, independent of other groundwater resources in the region?
5. How would the Lake Oroville and/or other reservoirs best be reoperated in order to provide substitute water to the vulnerable parties when needed and to release environmental flows in the spring?
6. What are the magnitude, duration, frequency and timing of environmental flows needed to produce biological benefits? What is the volume of water entailed and how can this be controlled and redirected for beneficial use?
7. How would periodic high flow in the Feather River or the Sacramento River influence the balance in the Delta and what opportunities would this create for balance regulatory obligations and export opportunities?

The studies and activities that will allow for the collection of the above data are detailed in section 3, below.

2.8 Data management

The partners will establish a consolidated data management system to be administered by the planning director and his/her staff. As the results of technical analyses and studies are received and processed for planning activities, the new data will be summarized for inclusion in the periodic quarterly report of progress to partners and made available for consultation by all interested stakeholders and the public. It will also be archived in a manner consistent with the state's data management system to facilitate data sharing and response to any state data needs to support SWAMP, GAMA and CERES.

One of the major issues facing additional conjunctive management initiatives, according to Bulletin 160, is lack of data within a complete regional network to monitor groundwater levels, water quality, land subsidence, or the interaction of groundwater with surface water and the environment. The bulletin states that additional investment in a monitoring network and data collection can help reduce uncertainty (DWR, Bulletin 160-03, (2005), at 4-4). This planning effort, and the new data it will generate, will fully support this aspect of statewide data needs. Bulletin 160 includes explicit recommendations to help promote additional conjunctive management. **"**Additional monitoring and analysis is needed to track, both statewide and regionally, changes in groundwater levels, groundwater flows, groundwater quality (including the location/spreading of contaminant plumes), land subsidence, changes in surface water flow, surface water quality, and the interaction and interrelated nature of surface water and groundwater. There is a need to develop comprehensive data on existing, proposed, and potential conjunctive management projects throughout the state and identify and evaluate regional and

statewide implementation constraints including availability of water to recharge, ability to convey water from source to destination, water quality issues, environmental issues, and costs and benefits" (DWR, Bulletin 160-03, (2005), at 4-6).

In addition, the proposed IRWMP will improve knowledge of the effects of different flows on the health of aquatic and riparian ecosystems, and will enrich data and analytical tools to measure the adequacy of flows, as the need is indicated in Bulletin 160 (DWR, Bulletin 160-03, (2005), at 9-4).

2.9 Stakeholder involvement

The planning process will be built around stakeholder involvement, and includes an extensive outreach and participation process to ensure that all stakeholder needs, interests and concerns are understood and addressed in the IRWMP. As described in the work plan below, the first task of this planning effort will consist of an identification of all stakeholders, including the parties who are at risk, or may perceive that they are at risk, from more aggressive pumping of the Lower Tuscan Formation before all of the geohydrologic uncertainties have been resolved. For each of these parties, the planning process will develop a risk management/elimination strategy. Both of these steps will be accomplished with the direct and ongoing involvement of the stakeholders. The goal of the planning process is to present solutions that garner the assent of these stakeholders.

A preliminary list of stakeholders is as follows:

- Current project partners
    - Glenn-Colusa Irrigation District
    - Natural Heritage Institute
    - Orland-Artois Water District
    - Orland Water Users Association
- Parties that have indicated strong interest and whose participation remains subject to ratification by their boards:
    - Western Canal Water District
    - Butte County
    - Butte County Resource Conservation District
- Potential Project Partners
    - Glenn County
    - Colusa County
    - Tehama County
    - Glenn County Resource Conservation District
    - Colusa County Resource Conservation District
    - Tehama County Resource Conservation District
- Current and potential future Lower Tuscan Formation groundwater users
    - City of Chico
    - Irrigators in the Cherokee Strip and other unincorporated groundwater users
    - Rancho Esquon communities
    - Durham Dade Mutual Water Company
    - Richvale Water District
    - Biggs West-Gridley Water District

    - Maxwell Water District
    - Provident Water District
    - Princeton-Codora-Glenn Water District
- Sacramento Valley environmental organizations
- U.S. Bureau of Reclamation
- California Department of Water Resources
- U.S. Fish and Wildlife Service
- NOAA Fisheries
- California Department of Fish and Game
- Cal-Fed Bay Delta Authority
- Northern California Water Association
- Other interested parties This would be us!

In practice, stakeholder involvement will occur through the following activities:

- Initial outreach to present the proposed IRWMP concept and identify and inventory stakeholders and their respective interests and concerns; as the planning effort moves forward, any additional stakeholders not initially identified will be incorporated into the process;
- Workshops at which the planning team will present risk management strategies for critique and refinement in an iterative fashion.
- Meetings at which the results from ongoing analyses and planning activities will be presented and feedback from stakeholders welcomed;
- Workshops to present and ratify the final IRWMP among stakeholders.

2.10 Disadvantaged communities

The region as a whole qualifies as disadvantaged when defining disadvantaged communities as those with median household incomes (MHI) below 80% of the statewide average. The median household income is well below the statewide average in each of the three counties that comprise this region, with Glenn county at $32,107 (67.6% of statewide MHI), Butte County at $31,924 (67.2% of statewide MHI), and Colusa County at $35,062 (73.8% of statewide MHI). This is explained in part by the nature of economic activity in the region. Due to the seasonal nature of agricultural employment, which forms the bulk of employment in the region, employment rates are highly variable through the year and overall unemployment is high. Indeed, regional unemployment for the period 1998-2002 averaged 14.7% compared with 5.6% for the entire state of California.

The water supply and water quality needs described in this proposal are hence those of a region that is disadvantaged relative to the rest of the state. The proposed IRWMP will directly benefit the region as a whole by improving water supply reliability through the access to a new water resource, and by increasing local revenues from transfers, which will also serve to improve water supply reliability through needed capital investments. In addition, any beneficial effects of the new water management strategy on crop yields, such as through improved temperatures for rice cultivation, will lead to direct economic benefits in the form of increased employment and revenues in the agricultural sector.

Stakeholders from all local sectors affected by water management, directly or indirectly, will be invited to participate in the planning process. This include growers, agricultural workers, local water user associations and all parties that will have an interest in the defining the plan and ensuring that its outcomes bring them benefits.

2.11 Relation to local planning

Local groundwater management plans and county ordinances vary by authority/agency and region, but typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, and protect groundwater quality. The proposed IRWMP would coordinate with all of the existing provisions and plans for water management. In addition, the Basin Management Objectives (BMOs) that have resulted from local planning and policy efforts would be advanced through the proposed IRWMP, and would provide an important framework within which to inscribe the regional water management strategies to be developed.

Local regulations governing Glenn-Colusa Irrigation District include GCID's AB3030 Plan, Glenn County Ordinance 1115, and Colusa County Ordinance 615.[12] The Butte County Department of Water and Resource Conservation has published an Integrated Water Resources Plan[13]. The goals of this Plan, including enhancement of water quality and mitigation of groundwater overdrafting, will be advanced by the project. How can massive pumping to see what happens with the aquifer, which may lead to overdrafting and moving toxic plumes farther and faster than they would naturally flow possibly enhance water quality? Overdrafting has already happened in Durham, how will this mitigate that? Similarly, in Glenn County, the Water Advisory Committee (WAC) develops water planning objectives, including water quality, comprehensive groundwater monitoring, and adaptive management[14] Butte County has an AB 3030 Groundwater Management Plan that under the Water Code allows the County to assume the responsibilities of a Water Replenishment District. Is this something the County actually intends to do? What are the costs? Who pays? It is cheeky to base this plan on the pretense that a replenishment project will occur before there is agreement by the voters who will be paying the costs. The proposed IRWMP would take into account and integrate with all AB3030 Plans. Butte's Integrated Water Resources Plan is a part of the Sacramento Valley Integrated Water Resources Plan, and was developed under the original Phase VIII agreement. The Colusa County Resource Conservation District (CCRCD) has published a Long Range Plan for 1998-2008[15]. Objectives of the CCRCD Long Range Plan, which will be advanced by the project, include: flood control management; improving water quality and development; and conserving and improving wildlife and fishery habitat.

The districts in the region manage a number of programs aimed at improving water use efficiency. These include a water reuse programs, water conservation programs, groundwater conjunctive water management programs, and an in-basin water transfer program. An aggressive drainwater recapture program, which recaptures both deep percolation to the groundwater and tailwater runoff from cultivated fields, is a part of Glenn-Colusa Irrigation District's overall water management program. GCID adopted a Water Transfer Policy in 1995. This policy identifies agricultural water users within the Sacramento Valley as the highest priority, and

[12] Short-Term Work Plan for Glenn/Colusa County, at 13 (2001).
[13] At www.buttecounty.net/waterandresource
[14] At http://www.glenncountywater.org
[15] At http://www.carcd.org/wisp/colusa/lr-plan.htm

environmental purposes as the second highest priority for future water transfers. An In-basin Water Transfer Program was introduced in 1997, which provides for up to 20,000 ac-ft to be transferred to neighboring lands in full water supply years. The proposed IRWMP will coordinate with all of these pre-existing local programs[16].

The dynamics between the two levels of planning documents – the proposed IRWMP and existing planning documents around water management -- are expected to consist of ongoing feedback and coordination so as to avoid redundancy while assuring complementarity and completeness in terms of the objectives advanced in the proposed IRWMP. As the regional partnership is launched, it will be essential to carefully review all existing planning documents and use them as a point of departure for the proposed planning effort. As new water management strategies are developed, they will either inform and lead to modifications in existing planning documents, or be harmonized with those documents.

2.12 Agency coordination

The proposed plan will actively promote the coordination and cooperation between relevant local, State and federal agencies in each of its components. The support of the Department of Water Resources (headquarters and Northern district office) and of the Bureau of Reclamation will be key with regard to the possible redesign of CVP and SWP contracts to reallocate surface water according to new conjunctive management arrangements**.** The benefits of the proposed IRWMP can only be realized with full cooperation and coordination between the CVP, SWP, and other local surface water suppliers in conjunction with the local water users that overlie the Lower Tuscan Formation aquifer system. The consultative workshops to be held throughout the planning process will thus include representatives from all of the relevant state and federal regulatory agencies, as well as local land-use planning decision-makers whose input into water use and allocation will be key.

3. WORK ITEMS

3.1 Work Plan Components

The pathway to this integrated regional ground and surface water management plan will require three processes. The first two are parallel, iterative and interactive, converging on the third:

1) The first is to illuminate the optimal hydrologic management scenario, involving reservoir reoperation, and in lieu groundwater storage and extraction arrangements. We will arrive at that scenario through a process of scenario development, gaming and selection involving the full range of potentially-affected water management institutions, political jurisdictions, state and federal water projects, fishery agencies, groundwater users and other stakeholders. The hydrologic planning requires using the CALSIM II platform to simulate a range of management alternatives. Note that the implementation of the IRWMP will necessarily be adaptive, as mentioned in section 2.5 above. Therefore, any "optimal hydrologic scenario" developed in the planning process will need to be flexible enough to adapt to changing conditions and/or new knowledge acquisition regarding hydrologic conditions during implementation.

[16] Phase 8 Draft EIR: Colusa Sub-Basin, at 2-3 (2005).

2) The second is to design legal and institutional arrangements to provide the required hydrologic, financial and water rights guarantees needed for the scenario to be implemented. Designing the management arrangements can be best accomplished through a series of workshops involving legal and institutional representatives from the stakeholder communities. NHI has gained much experience in designing such legal and institutional arrangements in the course of its work on conjunctive use over the past several years, and NCWA provides an ideal forum for these workshops. The goal of this process is to garner the concurrence and active engagement of all indispensable stakeholders to create the necessary legal arrangements—by contract, joint powers authority, special legislation, or otherwise.

3) The third is the adoption of the resulting integrated regional plan for conjunctive management of the Lower Tuscan Formation by the management agencies and political jurisdictions. This process will also include formal negotiations with the legally constituted governmental bodies that must implement the resulting plan.

Thus, the physical assessment of the management alternatives will inform the institutional design decisions and these will inform the selection of the management alternatives, in iterative fashion.

The work plan is outlined below. In all of these activities, the partners will consult with and utilize data, analyses and expertise provided by the Department of Water Resources, which has pledged its full cooperation, and the U.S. Bureau of Reclamation, from which we expect the same. Reciprocally, this project will contributed substantially to the ongoing research being conducted in the Sacramento Valley by these same agencies.

Activity 1: Initial, final and periodic workshops of project partners and Stakeholders

From beginning to end and throughout the planning process, the partners will convene workshops to vet the objectives, process, risk avoidance strategies, and elements of the emerging integrated plan in order to foster ownership and concurrence among stakeholders. Critical states will include the development of management scenarios for analysis, selection of the scenario to be embodied in the IRWMP, and the design of the institutional arrangements to implement that scenario. These workshops will bring together the following interests to help design and ratify the planning process:

- Current project partners
  - Glenn-Colusa Irrigation District
  - Natural Heritage Institute
  - Orland-Artois Water District
  - Orland Water Users Association
- Parties that have indicated strong interest and whose participation remains subject to ratification by their boards:
  - Western Canal Water District
  - Butte County
  - Butte County Resource Conservation District
- Potential Project Partners

    - Glenn County
    - Colusa County
    - Tehama County
    - Glenn County Resource Conservation District
    - Colusa County Resource Conservation District
    - Tehama County Resource Conservation District
- Current and potential future Lower Tuscan Formation groundwater users
    - City of Chico
    - Irrigators in the Cherokee Strip and other unincorporated groundwater users
    - Rancho Esquon communities
    - Durham Dade Mutual Water Company
    - Richvale Water District
    - Biggs West-Gridley Water District
    - Maxwell Water District
    - Provident Water District
    - Princeton-Codora-Glenn Water District
- Sacramento Valley environmental organizations
- U.S. Bureau of Reclamation
- California Department of Water Resources
- U.S. Fish and Wildlife Service
- NOAA Fisheries
- California Department of Fish and Game
- Cal-Fed Bay Delta Authority
- Northern California Water Association
- Other interested parties

Activity 2: Lower Tuscan Formation Recharge Investigation

Under current hydrologic conditions it is hypothesized that the Lower Tuscan Formation aquifer system derives much of its recharge from streams seepage and from infiltration of precipitation and applied irrigation water. The seepage is believed to occur along the northeastern margin of the Sacramento Valley.

There is a potential that increased groundwater extractions from the Lower Tuscan Formation as part of a conjunctive use project could increase stream seepage. Implementing a stream seepage monitoring program would provide the data necessary to better quantify the current stream depletion baseline, and quantify any changes that may occur if a program is implemented. This is an important environmental program element because many of these streams provide critical habitat for the endangered spring run Chinook salmon

As proposed, a stream flow monitoring program will be implemented for the following streams:

- Butte Creek
- Big Chico Creek
- Little Chico Creek

- Mill Creek
- Deer Creek
- Rock Creek
- Mud Creek

On each creek, the stream geometry will be surveyed both upstream and downstream of where it crosses the Lower Tuscan Formation. At these points, a staff gauge or stream gauge will be installed and a rating table will be established to correlate stage with flow.

To develop the full potential for a regional conjunctive use program, the ability to recharge the lower Tuscan Formation, either by direct or in-lieu methods, must be evaluated. To determine the feasibility of a direct recharge program for the lower Tuscan Formation aquifer system, a GIS data base will be developed as part of this study. The GIS will catalog on an areal basis all the physical parameters associated with recharge along the potential recharge corridor. Such parameters will include but are not limited to:

- Geology and geologic properties
- Soils and soil properties
- Topography
- Hydrology
- Conveyance facilities
- Water rights and sources of water
- Native vegetation
- Land use
- Cultural and archeological areas of interest

Utilizing this GIS, areas will be identified where direct recharge may be feasible. Several infiltrometer tests will be conducted in each of these areas to confirm the soil properties and provide additional data for preliminary design of direct recharge facilities. Conceptual direct recharge programs and cost estimates then will be designed for these areas. All this on the $12,000 identified in the budget as set for Lower Tuscan Formation Recharge Investigation? A footnote states that "the anticipated level of effort for this activity is estimated at $150,000" and that "the Northern District Office of DWR is interested in undertaking the technical work for this activity subject to available resources". But what if resources do not happen to be available? Will aggressive pumping continue if such vital research is not done as promised here?

Activity 3: **Use CALSIM II and other hydrogeologic models (such as Stony Creek Fan, IGSM II Groundwater Model (completed); and the Butte County IGSM II model to be completed in FY 2005-06) to simulate the Lower Tuscan Formation and the existing surface water supply system**

This activity will characterize the set of parameters that are essential for integrating the lower Tuscan into a system-wide context. To the extent and when possible, these parameters will be defined based on analysis of hydrogeologic

fieldwork and numerical groundwater modeling. NHI will assist in the parameter definition process by collaborating with DWR to assemble the information needed inform the CalSim-II simulation described below and ultimately to conduct numerical modeling of the lower Tuscan that will be necessary to full characterize the formation. It will be necessary to upgrade CALSIM II so it can simulate and evaluate the water management alternatives described in Activity 5, below. One important function of this Activity will be to determine how restrictions on the location, pumping rate, timing of extractions and depth of groundwater wells can assure that they will not interfere with existing groundwater pumpers in the Big Chico Creek Watershed.

Activity 4: Define three hypothetical water delivery systems from the State Water Project (Oroville), the Central Valley Project (Shasta) and the Orland reservoirs sufficient to provide a full and reliable surface water delivery to parties now pumping from the Lower Tuscan Formation

The purpose of this Activity is to construct and then compare the performance of three alternative ways of furnishing a substitute surface water supply to the current Lower Tuscan Formation groundwater users to eliminate the risks to them of more aggressive pumping of the Formation. These alternatives will then be modeled and their performance evaluated in Activity 5. This will lead to a selection of one or a mix of these strategies for economic analysis and incorporation into the proposed IRWMP.

Activity 5: Define a range of environmental flow improvements for both the Sacramento River below Shasta and Keswick dams and the Feather River below Oroville and Thermalito dams in terms of magnitude, duration, frequency, seasonality and reach

The objective will be to define an environmental flow target that will restore in stream and riparian ecosystem processes to the maximum extent compatible with the protection of the interests of the riparian landowners in the floodplain. This will be defined by all of the project partners and representatives of the affected landowners so as to avoid any uncompensated risks. This flow target will represent the maximum flow in a range of environmental flows that will be defined for purposes of the modeling work described below. The range may make various assumptions about levee setbacks in the floodplains. HEC models will be used to estimate the river flow-land area interfaces.

Activity 6: Develop scenarios involving various:

- Rates, volumes and locations of pumping of the Lower Tuscan Formation for local water supply and for water marketing outside of the Sacramento basin.
- Groundwater recharge and recovery options
- Substitutions of surface water from the SWP, CVP or Orland system to improve the water supply reliability for existing users of the Lower Tuscan Formation (the hypothetical water delivery systems defined in Activity 3)
- Modified reservoir releases to provide those substitute supplies and to achieve environmental flow improvements

- Banking of SWP and CVP entitlements in the Lower Tuscan Formation by the contractors
- Groundwater substitution transfers drawing on the Lower Tuscan Formation by CVP and/or SWP contractors through the Federal and State Projects when necessary to compensate for reduced refill in Shasta or Oroville due to substitute water deliveries to the current Tuscan Formation pumpers
- Groundwater substitution transfers by CVP and/or SWP contractors through the Federal and State Projects as useful to integrate the Lower Tuscan Formation into the Central Valley water supply system to contribute to system-wide reliability improvements.

Activity 7: Using CalSim-II to compare and evaluate the alternatives developed in Activities 3, 4 and 5.

To facilitate this Activity, we will first construct a simple spread sheet model of the variables itemized in Activity 5 to get a preliminary sense of how they work together and which permutations of the variables are the most promising. For these "finalists", we will then use CalSim II to conduct more detailed and definitive modeling runs that will determine the optimal configuration in terms of the objectives of the IRWMP and the avoidance of risks stakeholders.

Activity 8: Carry out detailed economic analysis of the best performing scenarios, including the costs of any proposed new infrastructure, groundwater pumping, voluntary flood easements (if any, substitute water supplies, etc.

The hydrologic feasibility modeling will illuminate the scenarios that best satisfy the planning objectives and eliminate the hydrologic risks. These best prospects will also carry a price and benefit tag. Many of these costs will be absorbed by the beneficiaries, but some will also require external support. In this activity, we will determine the scenarios that are most financeable and consider the feasibility of defraying the residual costs. The surviving candidates will be those that provide the greatest benefits relative to the costs (if any) that will require external financing. We will use conventional cost/benefit calculations to determine these options.

Activity 9: Select the best performing scenario(s) in terms of satisfaction of the shared water management objectives of the IRWMP as described in the proposal

Predictably, more than one scenario will emerge as the most viable candidates from the hydrologic and economic perspectives. Selecting among these options must be a community choice. That community consists of not just the partners to this planning effort, but all stakeholders and political leaders who share a common fate in the decisions on how to best utilize the Lower Tuscan Formation as a major new water supply and environmental enhancement asset. This is the most important stage at which to engage the entire community in vetting the options and selecting the optimal one. The partners will at this juncture convene that community to consider the options, tradeoffs and preferences. Out of this stakeholder process, the choice that maximizes benefits and minimizes disbenefits will be selected , with a view toward incorporating into the IRWMP the

configuration that will the implementing agencies and jurisdictions will uniformly embrace.

Activity 10: Constraints and opportunities analysis and resolution

In this Activity, the partners will address the institutional, legal and regulatory barriers to the utilization of the SWP and CVP to integrate the Lower Tuscan Formation into the local water supply system and into the Central Valley wide water supply system. Groundwater substitution transfers of water in storage in Oroville or Shasta will require the participation and facilitation by DWR and the Bureau. The partners will enter into a process with these agencies to:

- Itemize and assess the barriers and opportunities
- Negotiate workable solutions to the barriers
- Incorporate these agreements into the IRWMP.

Activity 11: Assess and eliminate or manage all risks to any stakeholder associated with the selected scenario

The scenario will be selected in part to minimize or compensate all risks—hydrologic, economic or legal—to any stakeholder. To do this successfully, the planning process must identify such potential risks and implement risk avoidance strategies. The first and periodic workshops will help ascertain the risks and effective management strategies. But a proactive outreach to stakeholders will also be used to assure that this Activity is entirely satisfying to the current users of the Lower Tuscan Formation and other stakeholders.

Activity12: Design acceptable legal and institutional arrangements to eliminate or manage risks and incorporate them into an implementable IRWMP

The IRWMP envisioned will be a new construct, never before implemented in California, or elsewhere. Preliminary analysis by the Natural Heritage Institute confirms that the necessary institutional arrangements can be implemented through a skein of contractual arrangements among the reservoir operators, groundwater users, water rights holders, end-use beneficiaries, and environmental restoration agencies and organizations. Designing these arrangements requires a sophisticated understanding of California and federal law, regulations, and administrative practices. The partners possess this expertise. It must in this activity be deployed to spell out the term and conditions of the contractual arrangements that will be necessary to implement the preferred alternative.

Activity 13: Draft, negotiate and obtain approval of IRWMP

The in-basin partners will draft the proposed plan and present it to the water management authorities and political units overlying the Lower Tuscan Formation for their consideration, approval and implementation through a subsequent agreement. This could take the form of a joint powers authority, a contractual arrangement or a less formal memorandum of understanding as the necessary

parties shall determine. The approval and adoption process will entail providing information, responding to questions and issues and likely some modifications of the proposal plan as necessary to garner concurrence of all of the implementing agencies. No entity that declines to approve would be bound by the resulting plan.

Activity 14: Preparation and submittal of quarterly reports, final report and other written documents, including a statement of benefits to be created during proposal implementation

DWR and SWRCB will want to know that the state's resource have been well used to produce the IRWMP and that the milestones described in this work plan have been accomplished. To provide this satisfaction, the applicant, Glenn Colusa Irrigation District will provide quarterly progress reports and a final report which will, in fact, constitute the IRWMP itself. These reports and the final Plan will document the benefits that the Plan is designed to produce. This Plan will be submitted to the implementing agencies for their adoption.

Activity 15: Fiscal Administration of the Grant Funds

4. WORK BUDGET

Please see Table 2, Attachment 3b.

5. WORK SCHEDULE

Please See Table 3, Attachment 3c.