

**Lake Elsinore & Canyon Lake Nutrient TMDL Sampling and Analysis Plan**

**USFS - San Bernardino National Forest**

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## Introduction

The following sampling and analysis plan (SAP) is presented to address the Forest Service's agreed "in-lieu" contribution to the Lake Elsinore/Canyon Lake Total Maximum Daily Load (TMDL) Task Force. The San Bernardino National Forest (SBNF), in conjunction with the Cleveland National Forest, has developed this SAP for monitoring and analyzing the San Bernardino National Forest, San Jacinto Ranger District for sources of total phosphorous and to identify a location for future trend and storm monitoring. The collected information can be used for future management and planning,

This SAP is due to Santa Ana Regional Water Quality Control Board (RWQCB) by June 1, 2006 to meet an implementation deadline of the TMDL as detailed in the February 2, 2006 correspondence between the RWQCB and the SBNF. An annual report is due annually by August 15. This SAP may be amended and updated by Dec. 31, 2006.

This report uses the format presented by the Environmental Protection Agency (EPA) (2002) Data Quality Objectives (DQO) process. EPA recommends using the DQO Process when data are being used to select between two opposing conditions, such as determining compliance with a standard. The DQO process:

- Provides a good way to document the key activities and decisions necessary to address the problem and to communicate the approach to others.
- Involves key decision makers, other data users, and technical experts in the planning process before data collection begins which helps lead to a consensus prior to beginning the project and makes it easier to change plans when circumstances warrant because involved parties share common understandings, goals, and objectives.
- Develops a consensus approach to limiting decision errors that strikes a balance between the cost of an incorrect decision and the cost of reducing or eliminating the possible mistake.
- Saves money by greatly reducing the tendency to collect unneeded data by encouraging the decision makers to focus on data that support only the decision(s) necessary to solve the problem(s). When used with a broader perspective in mind, however, the DQO Process may help identify opportunities to consolidate multiple tasks and improve the efficiency of the data collection effort.

In the Addendum Staff report to the TMDL (December 2004), the RWQCB staff stated, "The modeled phosphorus load from the forest land in the San Jacinto River watershed is higher than the median and/or average phosphorus load from other western forests in the US. It is unclear to staff if this is due to the fact that some human-induced disturbance is occurring on forested lands (i.e. septic systems, campgrounds, etc). Staff has asked US Forest Service staff to provide information on exact land uses within the lands under their jurisdiction. Until those data are obtained and reviewed, staff determined that a five percent reduction from the current San Jacinto River watershed forest land phosphorus

load is needed to ensure that the phosphorus loads are within the range of other natural US forests.”

One aspect of the proposed project is to provide RWQCB with the information requested regarding land management practices and to isolate information about phosphorous loads from lands not under the jurisdiction of the Forest Service.

This report is separated into two distinct chapters because the proposed sampling fulfills two purposes. The first chapter will discuss the special study that will be conducted to evaluate phosphorous loading from various land management practices. The second chapter will discuss the classic TMDL storm-based compliance monitoring that the SBNF has agreed to conduct in conjunction with the LE/CL TMDL Task Force.

## Chapter 1 (Upper Watershed Special Study)

### Step 1: State the Problem

**Purpose:** To define the problem so that the focus of the study will be unambiguous.

#### ***Identify members of the planning team***

- SBNF Forest Hydrologist: Sampling and Analysis Plan (SAP) primary author, coordinator, data collection, statistical data analysis and conclusions
- Lands, Minerals, and Resources Staff Officer on San Bernardino National Forest/ Resources Staff Officer on Cleveland National Forest
- Region 5 Regional Hydrologist
- SBNF Forest Aquatic biologist: consultant on locations of groundwater dependent ecosystems and aquatic resources, intermediary with State Fish & Game and Fish & Wildlife Service about emergency consultation (50 CFR 402.05), labs used, lab standards, other QA/QC
- Zone Soil Scientist: consultant on monitoring parameters relative to natural constituents and processes in the watershed in question
- Forest Supervisor: line officer, post study decision maker

#### ***Primary Decision Maker***

The San Bernardino National Forest Supervisor with consultation from team members: following data analysis, the results will be returned to the Forest Supervisor. If problems are identified or future work is needed, then the Forest Supervisor will make that decision and justify future work.

#### ***Concise Problem Statement***

Are there sources of phosphorous that can be identified as originating from various land management practices contained in and around portions of the San Bernardino National Forest, San Jacinto Ranger District? Can the land management practices influencing the total phosphorous loading be shown to be statistically significant when comparing upgradient and downgradient data?

#### ***Background Site Conditions***

The San Bernardino National Forest, San Jacinto Ranger District falls within the regulatory control of the Santa Ana Regional Water Quality Control Board (RWQCB) on the west and the Colorado River Regional Water Quality Control Board on the east.

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There are three 5<sup>th</sup> Field watersheds in the San Jacinto Ranger District that discharge water towards Canyon Lake and Lake Elsinore.

- Upper San Jacinto, #1807020202
- Garner, #1807020201
- Bautista, #1807020203

The primary variable for the San Jacinto Ranger District relative to the Canyon Lake/Lake Elsinore nutrient TMDL is the land owner status of the lands above the USGS Cranston gage used during the modeling process. Data collected at the Cranston gage was used to approximate the total phosphorous loading coming from forest/open space. However, the land management practices above the USGS Cranston gage include SBNF lands, the unincorporated community of Idyllwild, lands owned by Lake Hemet Municipal Water District, lands regulated by the State of California, and various private inholdings devoted to various activities.

The following table contains GIS-based acreage estimates of land managed by the SBNF and private in-holdings not managed by the SBNF. For land not managed by the SBNF, the SBNF does not keep current records of the private land management practices.

5 <sup>th</sup> Field Watershed	Owner	Approx. Acreage	Percent of Total Acreage
Upper San Jacinto	SBNF	50447	75%
	Indian Reservations	1802	3%
Upper San Jacinto Private In-holding	Idyllwild	5227	8%
	Orchards & Lake Hemet MWD	2486	4%
	Small parcels	2134	3%
	State Park	5163	7%
Garner	SBNF	33313	79%
	Indian Reservation	301	1%
Garner Private In-holding	Herkey Creek/Apple Canyon Road properties	2949	7%
	Fobes Canyon/Morris Ranch Road properties	1083	3%
	Pine Meadow	3356	8%
	Associated with Lake Hemet MWD	~1000	2%
Bautista	SBNF	25152	95%
Bautista Private In-holding	State Penitentiary	254	1%
	Ramona Reservation	274	1%
	Tripp Flats/small parcels	718	3%

The Forest Service Land Management Plan details the land uses and Desired Conditions for each of these “places” and is included here.

## **Bautista 5<sup>th</sup> Field Watershed = Anza Place**

**Theme:** Chaparral-covered hillsides braided by seasonally flowing streams. Anza offers a distinctive, rural character, and remote open space, just miles from major urban centers. The Juan Bautista de Anza National Historic Trail marks the passage of early Spanish explorers through Bautista Canyon.

**Settings:** The Anza Place is located within the San Jacinto foothills, stretching from the valley communities of Hemet and San Jacinto to Cahuilla Mountain and the southwestern slope of Thomas Mountain. To the south lies the community of Anza, named after the Spanish explorer Juan Bautista De Anza, who led an overland expedition in this area in the 1770s. De Anza traveled through the heart of this landscape on his expedition from Tubac, Arizona north to San Francisco. Visitors often travel through Bautista Canyon revisiting this historic route, or as a short cut from Hemet to Anza. The Cahuilla Mountain Research Natural Area located here is dedicated to the study of Coulter pine and black oak. Portions of the active Rouse grazing allotment are present within this Place.

The climate is temperate, with sub-humid to hot summers at the lower elevations of 1,500 feet; giving way to cooler temperatures in the higher elevations. Most of this land is semi-arid with no lakes or man-made reservoirs, and all streams are dry in the summer except for springs fed from the higher mountains. Annual precipitation ranges from 10 to 30 inches per year, mostly in the form of rain. Steep mountains characterize the land, with narrow to rounded ridges and narrow canyons.

Traditionally, the Cahuilla Indians used these lands, and had extensive trade networks with neighboring tribes. Today, many areas within the Place continue to be used by the Cahuilla and their neighbors the Luiseno. Access to tribal collecting areas is adequate, but could be improved. In 1893, the reservation was established for the Ramona Band of Cahuilla Indians. The reservation is bordered by National Forest System land on three sides.

Grasslands in the valleys yield to a chaparral covered landscape at the lower elevations, including chamise, buckwheat, sage and mountain lilac. In the higher elevations, there are stands of canyon live oak, pine and bigcone Douglas-fir. Much of the landscape is dense chaparral on the slopes, with a riparian corridor along the Bautista Canyon bottom that contains diverse species of trees, shrubs, forbs, sedges, rushes and grasses. Wildland fire threat is ever-present here, along with the cycle of erosion and flood.

The southwestern willow flycatcher, the San Bernardino kangaroo rat, arroyo toad and Quino checkerspot butterfly occur within the Place. The biological diversity along the river corridors within this Place is unusually high. Critical habitat for San Bernardino kangaroo rat is designated close to the San Jacinto River. Bautista Creek possesses the largest number of endangered and Region 5 sensitive wildlife species of any location on the national forest. Designated critical habitat for San Bernardino kangaroo rat and

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proposed critical habitat for arroyo toad occurs in Bautista Canyon. Bautista Creek also supports the only population on the national forest of the endangered slender horned spine-flower. Alluvial fan scrub habitat is present. The encroachment of tamarisk (an invasive nonnative species within the creek corridor) reduces the water table and affects species diversity. There is critical habitat for the Quino checkerspot butterfly in the vicinity of Hixon Flat. Deer, quail, and mountain lions are present throughout the Anza Place. Private lands adjacent to the southern portion of the Place provide a regional habitat linkage connecting the San Jacinto Mountains to the Palomar Mountains on the Cleveland National Forest.

The Anza Place is sparsely populated, with most of the population located in the adjacent communities of Hemet, San Jacinto and the Anza Valley. No major highways transect this area, and there are only a few national forest dirt roads. Because of the limited access, the area is not a high-use recreation area. Most of the visitation focuses on hiking, biking, hunting and driving for pleasure. A designated OHV route system is present. Remote camping is available. Trash dumping and target shooting in unauthorized locations occurs frequently.

**Desired Condition:** The Anza Place is maintained as a historic and natural appearing landscape that functions as a transition zone to the higher mountains beyond, as well as providing a natural continuous expanse of vegetation as viewed from the High Country. The valued landscape attributes to be preserved over time are the mosaic pattern of the chaparral-covered hills, the ribbons of diverse native vegetation in the canyons and riparian areas, the presence of oaks, bigcone Douglas-fir and pine in higher elevations. Native American access to traditional gathering areas is improved and areas are protected. Heritage resource sites are protected. Active grazing allotments are sustainable and contain a high proportion of native species. Chaparral communities and timber stands are at pre-fire suppression conditions. Habitat conditions for threatened, endangered, proposed, candidate and sensitive species are improving over time. Tamarisk and other exotic species are reduced over time. Accurate national forest boundaries are reestablished and maintained.

**Program Emphasis:** Community protection from wildland fire is of the highest priority. It will be emphasized through public education, fire prevention, forest interpretation and fuels management. Forest health projects will be implemented to remove dead trees, reduce stand density, and promote pre-settlement fire return intervals. Reforestation projects will maintain tree diversity. Visitor experiences will be enhanced through interpretation of the historic route of Juan Bautista De Anza National Historic Trail. The improvement of the OHV route system will be explored, as will a motorized right-of-way access for fire suppression in Reed Valley. Enhancement of wildlife habitat for threatened, endangered, proposed, candidate and sensitive species, such as the southwestern willow flycatcher, arroyo toad, San Bernardino Kangaroo rat, Quino checkerspot butterfly, and slender horned spineflower will be emphasized in all management activities. Maintaining the unique biological diversity found in Bautista Creek and the San Jacinto River, removal of tamarisk and other exotic species, and management of the national forest portion of the regional habitat linkage to the south will

also be emphasized. Heritage resource sites and Native American gathering areas will be protected. Native American tribes will become partners through protocol agreements and provide assistance with interpretation and management of traditional gathering areas. The California Site Steward Program will be implemented. Accurate national forest boundaries along the Wildland/Urban Interface will be reestablished and maintained. Law enforcement actions and activities will be emphasized to eliminate unauthorized shooting and trash dumping in streamside areas and to promote public and employee safety.

## **Garner 5<sup>th</sup> Field Watershed = Garner Valley Place**

**Theme:** Green meadows and historic ranchland in an expansive mountain valley frame the Garner Valley Place. Lake Hemet and surrounding areas offer popular recreation opportunities and scenic vistas of an open pine forest.

**Setting:** Garner Valley Place is located within the San Jacinto Mountain Range. The San Jacinto Wilderness borders the Place to the north, while the Santa Rosa and San Jacinto Mountains National Monument forms its eastern boundary. California State Highway 74 (the Palms to Pines Scenic Byway) traverses this area from southeast to northwest. Garner Valley offers access and views into the San Jacinto Wilderness.

Elevations within the Garner Valley Place range from approximately 2,500 feet to over 8,500 feet. Historically, the area has been mined and grazed; grazing continues today. The Paradise and Garner Grazing Allotments are active. Portions of the Rouse and Wellman Grazing Allotments are also active.

The mountain climate ranges from hot to temperate in the lower elevations and cold temperatures in the higher elevations. Annual precipitation varies from 16 to 30 inches, with snow falling mostly in the higher elevations. Water is scarce in the summer months, except for scattered springs and groundwater. Lake Hemet is the largest body of water in the area. It is an artificial reservoir providing water to the local area, and boating and fishing opportunities. Striking rock outcrops and unique landforms are found along the desert divide, which forms the boundary with the Santa Rosa and San Jacinto Mountains National Monument.

The Garner Valley Place is blanketed with basin sagebrush intermingled with meadow plants and nonnative grasses. Jeffrey pine grows along the valley's edge, while at the south end pinyon/juniper woodlands prevail. Ponderosa pine stands and mixed conifer forest are found on the slopes of Mt. San Jacinto, with lodgepole pine present at higher elevations. Parry pinyon and red shank chaparral are also present. Sagebrush encroachment is occurring in the valley and its adjacent timbered areas as a result of past fire suppression activities. Because sagebrush is highly flammable, the risk that fires will destroy the trees and convert the area to brush and grassland is high. Dense chaparral stands in timbered areas also threaten conifer vegetation. Substantial conifer mortality has created a fuel buildup that is a problem for community protection.

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The large acreages of montane meadow found here provide habitat for many unique plants and animals. The foothills above the valley support pebble plain-like habitat unique to the San Jacinto Mountains. The only known locations of Johnson's rock cress, a Region 5 sensitive plant species, are found in this Place. One of the only locations on southern California where bald eagles can be observed year-round is found at Lake Hemet. The highest known distribution for Quino checkerspot butterfly is found in the southeastern portion of the valley. Garner Valley meadows and adjacent uplands are important deer habitat where fire has been used to maintain habitat quality. A State Game Refuge located at the northern end of the valley provides protection for game species from hunting. The Cahuilla Indians were the earliest known people living in Garner Valley and it is believed that their ancestors settled in the Place thousands of years ago.

The Cahuillas' lived here for hundreds of years prior to European settlement and they continue traditional use of the land today. The Santa Rosa Band of Mission Indians' Reservation is located on the southeastern side of the Place. Historic Euro-American land uses of the Place include ranching, some mining, and later, recreation uses of Lake Hemet and local trails. Early ranchers cleared the pine-covered Garner Valley to create pastures for their cattle and horses.

Access to the national forest is a concern in Garner Valley, as the Forest Service does not hold public rights-of-way and private landowners allow limited access through their property. The proximity of local communities to national forest land has also led to numerous encroachments in the area.

This Place contains a variety of recreation opportunities, including mountain biking, hiking, hunting, fishing, camping, and equestrian use. Opportunities for primitive recreation are present in the San Jacinto Wilderness. Tool Box Spring Campground and Lake Hemet Picnic Area are located here, and the Pacific Crest Trail traverses the eastern boundary of the area along the desert divide. There is insufficient parking at some trailheads to accommodate users and conflicts occasionally arise among some hiking, biking, and equestrian trail users.

**Desired Condition:** Garner Valley Place is maintained as a historic and natural appearing landscape that functions as a recreation setting offering scenic vistas of open pine forests. The valued landscape attributes to be preserved over time are the natural appearing landscape views from the Scenic Byway, the presence of montane meadows, the Jeffrey pine forests along the valley's edge, the mixed conifer forests and bigcone Douglas-fir stands, and lodgepole pine in higher elevations. Heritage resources are managed to standard. Active grazing allotments are sustainable and contain a high proportion of native species. Chaparral communities and timber stands are at pre-fire suppression conditions. Habitat conditions for threatened, endangered, proposed, candidate and sensitive species are improving over time. Accurate national forest boundaries are reestablished and maintained. Rights-of-way to improve public access to national forest land are acquired.

**Program Emphasis:** Community protection from wildland fire is of the highest priority. It will be emphasized through public education, fire prevention, fuels management and direct suppression. Community protection projects identified in the San Jacinto Wilderness may be implemented to reduce the risk of wildland fire to communities. Forest health projects will be implemented to remove dead trees, reduce stand density, promote pre-fire suppression fire return intervals and reduce sagebrush encroachment. Reforestation projects will maintain tree diversity.

Management will focus on maintaining the open grassland character and expansive wet meadows and vistas of Garner Valley. Allotment management will be emphasized. Wherever possible, acquisition of land will be emphasized to improve public and administrative access, protect resources, and maintain open space and scenic qualities. Accurate national forest boundaries along the urban interface will be reestablished and maintained. Developed recreation sites will be improved and new recreation opportunities will be explored. Heritage resources will be protected and interpreted as appropriate. Enhancement of wildlife habitat for threatened, endangered, proposed, candidate, and sensitive species, such as bald eagles, Quino checkerspot butterfly and unique plant species will be emphasized in all management activities.

### **Upper San Jacinto 5<sup>th</sup> Field Watershed = Idyllwild Place**

**Theme:** A mountain hideaway of art and music nestled beneath jagged rocks and towering pines, Idyllwild is the gateway to the San Jacinto Wilderness.

**Setting:** The Idyllwild Place is located in the higher elevations of the San Jacinto Mountains and is characterized by steep canyons and jagged rocks. Elevations in the Place range from 2,000 feet to 10,804 feet at the top of San Jacinto peak. The San Jacinto Wilderness has long been a popular destination for visitors to this Place, and the newly created Santa Rosa and San Jacinto Mountains National Monument borders the eastern boundary. The spectacular features of the national forest provide the backdrop for this unique community. Idyllwild attracts and inspires many people interested in the arts. Because of its proximity to Palm Springs, this Place continues to receive a large number of international visitors. The Hall Canyon Research Natural Area, dedicated to the study of mixed conifer forest, and the Black Mountain Scenic Area are located here, as is Mt. San Jacinto State Park.

The mountain climate ranges from hot to temperate at the lower elevations and cold temperatures at the highest elevations. Surface water is scarce in the summer months, except for scattered springs and the perennial streams of the North Fork of the San Jacinto River and Fuller Mill Creek. Lake Fulmor, a small man-made lake, is located here as is Baytree Springs, an important drinking water gathering area for locals and visitors alike. Annual precipitation ranges from 16 to 30 inches, with snow falling mostly at the highest elevations.

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The San Jacinto foothills contain a mix of manzanita, sagebrush, buckwheat, chamise and scrub oak. In the higher elevations, the chaparral gives way to stands of bigcone Douglas-fir, mixed oak and conifer, including California black oak and canyon live oak. Coulter pine, sugar pine, Jeffrey Pine, ponderosa pine, incense cedar, white fir and lodgepole pine are also present. The Vista Grande and Soboba Grazing Allotments are currently vacant.

Many private inholdings are located within or adjacent to National Forest System lands in this Place. Fuel buildup has occurred in the chaparral and timbered portions of this Place, increasing the probability of large stand replacement fires. Fire hazard has been exacerbated by drought and a high level of tree mortality, presenting risks to private landowners and national forest facilities. Wildland/Urban Interface Defense and Threat Zones are needed to protect Idyllwild and surrounding communities. Use of prescribed fire is also needed.

This popular mountain Place contains unique biological diversity. A distinct population of mountain yellow-legged frog occurs here. California spotted owls are present. Southern rubber boas occur here at the southernmost portion of their range. San Bernardino flying squirrels are also known to have occurred here. A small amount of critical habitat for the San Bernardino kangaroo rat, and the arroyo toad is present along the San Jacinto River. A small amount of critical habitat for the Peninsular Range bighorn sheep is also present. The only known occurrences of the California bedstraw, a Region 5 sensitive plant species, occur here; lemon lilies are also present. The northern portion of this Place is an important element of the regional habitat linkage connecting the San Jacinto Mountains and the San Bernardino Mountain Front Country through the Banning Pass.

California State Highway 243 (entering the national forest from the north at Banning) runs southeast as the Palms to Pines Scenic Byway. This is a highly traveled scenic route where people can spend the day driving for pleasure. Access to National Forest System land within this Place is generally good, although some areas near the community of Idyllwild are lacking rights-of-way due to the large number of private in-holdings. The proximity of the communities to the national forest has led to numerous encroachments.

The Idyllwild Place was inhabited hundreds of years ago by the Cahuilla Indians and their ancestors. The Serrano and Luiseno Indians also traveled through, and possibly settled in this Place. Numerous trade routes traversed through this Place. The Morongo Band of Mission Indians' Reservation lies immediately north of the Place. Members of the Ramona Band of Cahuilla Indians, Santa Rosa Band of Mission Indians, the Soboba Band of Luiseno Indians, the Cahuilla Band of Mission Indians, and the Agua Caliente Band of Cahuilla Indians still have ties to the Place today. Settlers of European descent traveled to the Place in the late 1860s to log, mine, raise cattle and create a retreat. During the Great Depression, the Civilian Conservation Corp constructed Black Mountain Road, Tahquitz Peak Lookout, along with guard stations, trails, campgrounds and fuelbreaks.

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National Forest visitors find opportunities to hike, camp, fish, horseback ride and mountain bike, while rock climbers try their skills at climbing vertical faces of rock. Opportunities for primitive recreation are present in the San Jacinto Wilderness. Information on recreation opportunities is available at the newly renovated Idyllwild District Office. There is a high demand for snowplay here during the winter months. Bee Canyon is heavily used for recreational target shooting, and hunters find a variety of game in the more remote areas. The Pacific Crest Trail traverses through Idyllwild Place within the San Jacinto Wilderness. A non-motorized trail linking Idyllwild to Pine Cove on the national forest has been proposed with community support. A limited number of "easy" hiking trails can be accessed from Idyllwild Place. Opportunities for both mountain bike and off-highway vehicle use are limited. There is a designated OHV route system in the Angeles Hill/Indian Mountain area. Developed recreation facilities are in need of renovation.

Law enforcement staffing levels are inadequate to manage the number of users. Activities, such as trash dumping, unlawful off-road vehicle use, and property vandalism are reoccurring problems. Unlawful activities, such marijuana cultivation, methamphetamine lab dumps, and abandonment of stolen vehicles are increasing as the urban areas adjacent to the national forest are being developed. Protection of the numerous heritage resources located within the area is also a concern. Conflicts between recreational target shooters and OHV use are reoccurring problems in Bee Canyon.

**Desired Condition:** Idyllwild Place is maintained as a natural appearing landscape that functions as a recreation setting and wilderness gateway. The valued landscape attributes to be preserved over time are the natural appearing views from the scenic byway and Pacific Crest Trail, the presence of conifers above the 4,000-foot level, the current diversity of chaparral species at the foothill locations, and the presence of rock outcrops. Chaparral communities and timber stands are at pre-fire suppression conditions. Heritage resources are identified, protected and interpreted as appropriate. Traditional cultural properties are protected. Habitat conditions for threatened, endangered, proposed, candidate and sensitive species are improving over time. Accurate national forest boundaries are reestablished and maintained. A wide variety of dispersed and developed opportunities are maintained and improved.

**Program Emphasis:** Community protection from wildland fire is of the highest priority. It will be emphasized through public education, fire prevention, and fuels management. Community protection projects identified in the San Jacinto Wilderness may be implemented to reduce the risk of wildland fire to communities. Forest health projects will be implemented to remove dead trees, reduce stand density, and promote pre-fire suppression fire return intervals. Reforestation projects will maintain tree diversity. Conservation education, with a focus on the demonstration and interpretation of healthy forests, at the expanded District Office will be emphasized to enhance the experience of visitors and promote stewardship.

The scenic focus will be on maintaining views of jagged rocks and towering pines, especially from the scenic byway. Wherever possible, acquisition of land will be emphasized to improve public and administrative access and to maintain open space and

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scenic qualities. Accurate national forest boundaries along the urban interface will be reestablished and maintained. Trespass and encroachment will be reduced. Opportunities for a variety of new non-motorized trails (especially short, easy-to-moderate difficulty, day loop trails) and designated recreational target shooting and snowplay areas will be explored. Developed recreation sites will be improved. The Pacific Crest National Scenic Trail remains a priority for management and maintenance. The OHV route system in the Angeles Hill-Indian Mountain area is evaluated for needed improvement. Unauthorized OHV use is directed to designated routes. Law enforcement activities will be coordinated with other functional areas for the protection of national forest resources and the safety of national forest visitors and employees.

Enhancement of habitat for threatened, endangered, proposed, candidate and sensitive species, such as the mountain yellow-legged frog, California spotted owl, southern rubber boa and California bedstraw will be emphasized in all management activities. Surveys will be conducted to determine continued presence of San Bernardino flying squirrel. Activities will also be managed to maintain the regional habitat linkages to the north and west. Significant heritage sites will be protected and enhanced. Heritage resource sites and Watchable Wildlife areas will be managed and interpreted along travel corridors within the Place.

The preceding excerpts from the Forest Plan discuss the multiple use nature of the forest with numerous activities including a system of forest roads, campsites, off-highway vehicle/equestrian trails, hiking trails, etc. The Forest Service system roads are maintained for such needs as access to fight wildland fires, conduct fuels treatment projects to deal with mortality from drought and insect infestation, and general access to the intermingled public and private lands. The fuels treatment projects are designed to return the Forest to a fire regime natural for the climate and to protect the community of Idyllwild. All projects conducted on the SBNF are required to use Best Management Practices (BMPs) as detailed in numerous guidance documents (USDA Forest Service, 2000, 2005a, 2005b).

### ***Determination of Resources***

<b>Laboratory Analysis Costs (June 2006 – Sept 2006)</b>	
Cost per sample (Babcock Labs)	\$60
# of Sites	9
# of bi-monthly sampling dates	2
Total samples collected (with QA/QC)	22
<b>Total Analysis Costs for FFY2006</b>	<b>\$1,320</b>

Estimated Personnel and Equipment costs for FFY2006: \$5,000

**Estimated Total Study Costs for FFY2006: \$6,320**

<b>Laboratory Analysis Costs (Oct 2006 – Sept 2007)</b>	
Cost per sample (Babcock Labs)	\$60
# of Sites	9
# of bi-monthly sampling dates	6
Total samples collected (with QA/QC)	66
<b>Total Analysis Costs for FFY2006</b>	<b>\$3,960</b>

Estimated Personnel and Equipment costs for FFY2007: \$7,000

**Estimated Total Study Costs for FFY2007: \$10,960**

## Step 2: Identify the Decision

### *Principle Study Question*

Are there sources of phosphorous coming from Forest Service Land Management Practices and private land management practices statistically above the concentrations found in natural background data?

### *Alternative Actions & Decision Statements*

The following alternative actions and decision statements rely on the following terms:

- Downgradient sampling: When a pair or set of samples is collected, the sample from downstream
  - Upgradient sampling: When a pair or set of samples is collected, the sample from upstream
  - Background: There are two identified sampling locations that offer the opportunity to assess water quality for a “pristine” environment, where pristine is defined as an area with limited human interactions (no developed recreation, limited roads or trails, wilderness).
  - Statistical significance: Using standard parametric (if applicable) and non-parametric statistical tests of at least 90% significance, a difference in the mean or median of the data when comparing upgradient and downgradient data
- If the result of sampling in upgradient and downgradient pairs shows that no statistically significant human-caused sources of phosphorous on Forest Service lands above background levels can be identified, then
    - Consultation with the RWQCB will be conducted to determine if the added information is sufficient to re-evaluate the background load level from Forest Service lands,
    - Consultation with the RWQCB will be conducted to determine if the added information is sufficient to remove the Forest Service requirement for phosphorous reduction under the stipulation that continued BMPs be

## SAP

evaluated and reported on in accordance with the Management Area Agreement (MAA) between the Forest Service and the State Water Board.

- If the result of sampling shows statistically significant human-caused source(s) of phosphorous on Forest Service lands above background levels, then
  - If the sources are associated with Forest Service regulated activities, then restoration project(s) to reduce loading to the degree reasonable and feasible will be drafted and put forward for funding in consultation with the RWQCB.
    - Further sampling will be isolated and possibly enhanced in relation to the identified source area(s), whereas sampling in areas shown to not be sources will be discontinued.
  - If the sources are not associated with Forest Service regulated activities (private in-holdings such as Idyllwild or Lake Hemet MWD), then, in consultation with the RWQCB, the agencies responsible for the activities will be notified and the responsibility for the phosphorous loading will fall under the regulatory purview of the RWQCB.
    - Consultation with the RWQCB will be conducted to determine if the added information is sufficient to re-evaluate the background load level from Forest Service lands,
    - Consultation with the RWQCB will be conducted to determine if the added information is sufficient to remove the Forest Service requirement for phosphorous reduction under the stipulation that continued Best Management Practices (BMPs) be evaluated and reported on in accordance with the Management Area Agreement (MAA) between the Forest Service and the State Water Board.

## Step 3: Identify Inputs to the Decision

### *Information required to resolve decision statements*

#### **Required parameters**

The purpose of the special study is to determine possible source(s) of phosphorous from Forest Service regulated activities and from private in-holding activities. Therefore, the scope of the special study does not require the collection of all parameters required for standard TMDL storm loading monitoring (see Chapter 2). For consistency with the Task Force's other data collection, the SBNF has agreed to the use of Babcock Labs for data analysis. At the time of each grab sample, an instantaneous flow measurement will be made in the field. The following detail is an excerpt from the San Jacinto River Watershed TMDL Sampling Plan (Sept. 27, 2005) provided by the LE/CL TMDL Task Force.

Parameter	Holding time (d)	Field preserve	Pre-treat	Analysis method	Reporting limit	Units	Cost
Total phosphorous	28	H2SO4	Digest	SM 4500 P B E	0.05	mg/L	\$16
Total Suspended Solids	7	Unpres.		SM 2540 D	5	mg/L	\$12
Total dissolved solids	7	Unpres.	Filter	SM 2540 C	10	mg/L	\$12
Ortho phosphate (PO4)	see Ortho-P, we can manually add a data flag with this conversion, if required					mg/L	\$12
Turbidity	2	Unpres.		SM 2130 B	0.2	NTU	\$8
Flow	Field					cfs	
pH	Field						
Water Temperature	Field					°C	

At each identified location, samples will be collected once every two months, in accordance with Robertson (2003). By collecting data both from an upstream and a downstream location, the area in between the data collection points will be isolated and indicative of the loading from that area of land.

### ***Locations for sampling***

Best professional judgment was used in the determination of sampling locations, giving weight to the locations of Forest Service regulated activities as well as private in-holding activities that are outside the regulatory authority of the Forest Service. Access was also looked at in the decision of applicable sampling sites. The following descriptions indicate the approximate locations that samples will be collected. Prior to the first collection, these locations will be field verified and GPS locations will be recorded (using decimal degrees with 6 significant figures and appropriate metadata) for future sample collection activities.

- Points upstream and downstream of Idyllwild along Strawberry Creek (Figure B).
  - Upstream: San Jacinto Peak Quad Map, T5S R3E Section 5: San Bernardino FS system road 5S14 is near the boundary between Idyllwild and Forest Service system lands. This location drains a small land area from Suicide Rock to Marion Mountain to the Pacific Crest National Scenic Trail. The land is expected to give phosphorous concentrations indicative of upper watershed, forest conditions.

- Downstream: Idyllwild Quad Map, T5S R2E Section 23: Access from the end of roads in Idyllwild is possible and the collection point will be near Forest Service lands. These samples may show indications of the septic systems used in Idyllwild.
- Points upstream and downstream of private in-holdings along Highway 74 above Cranston station contain orchards (Figure C).
  - Upstream: Blackburn Canyon Quad Map, T5S R2E Section 28: A four-wheel drive road paralleling Highway 74 allows access to the South Fork San Jacinto River at the Forest Service boundary. This location encompasses flows from both Strawberry Creek and outflows from Lake Hemet.
  - Downstream: Blackburn Canyon Quad Map, T5S R1E Section 13: The South Fork San Jacinto River at the Forest Service boundary near the Cranston station should be indicative of additions from the North Fork San Jacinto River and overland runoff from orchards grown on private in-holdings, as well as additions from Caltrans activities along this stretch of Highway 74.
- A focused study of both water and soil samples will be conducted in the location of the Idyllwild waste water ponds that are under special use permit with the Forest Service (Figure C). As this permit is up for a new NEPA analysis and a new permit, it is contemplated that future sampling of this site and surrounding tributaries of the San Jacinto River be the responsibility of the permit holder.
- Idyllwild Quad Map; T6S R3E Section 4 and Section 7: this set of points is upstream of Lake Hemet. Downstream information will be coordinated with the Lake Hemet MWD (Figure D).
  - The first upstream location will likely be collected along Herkey Creek in the Herkey Creek County Campground. The drainage to this point will encompass the Herkey Creek watershed including Bonita Vista, the peak north of Pine Springs Ranch, the Fleming Ranch, San Bernardino FS system roads 5S05 and 5S21, the South Ridge Trail, and the Pacific Crest National Scenic Trail. About 25% of the land is private inholdings outside the control of the USFS.
  - The second upstream location will be along Highway 243 on one of the main inlets to Lake Hemet. Sampling will be conducted within the CalTrans Right-of-Way. These samples will encompass loads from a much larger land area, the Garner Valley, Thomas Mountain, Pine Meadow, and surrounding environs. The land management from this upper includes private and USFS permitting grazing allotments (see Table 1 above).
  - Coordination will be conducted with the Lake Hemet Water District to take advantage of any sampling currently taking place. This coordination will be done in association with the RWQCB as a bridge to the TMDL Task Force and will help in the delineation of additional stakeholders for the triennial review of the TMDL.
- Points in upper and lower Bautista Canyon (Figure E). This watershed has differing land management activities because the vegetation differs and the developed recreation opportunities are much fewer. It is contemplated that the forest/open space

concentrations of phosphorous could be different from this watershed compared to the San Jacinto River watershed.

- Upstream: Blackburn Canyon Quad Map, T6S R2E Section 20: A four-wheel drive road exits Bautista Canyon Road allowing access to the Bautista Canyon at the Forest Service boundary with the State penitentiary. This location encompasses flows from the upper half of the watershed.
  - Downstream: Blackburn Canyon Quad Map, T6S R1E Section 2: Bautista Canyon at the Forest Service boundary has access from the road. This location drains the entirety of the watershed and the majority (95%) of the land management practices is under Forest Service control.
- The ninth data point used for bi-monthly sampling will be the TMDL compliance point detailed in Chapter 2 below. Preliminary investigation of land management practices and access indicates a sampling location: Lake Fulmor Quad Map, T4S R2E Section 33: Forest Service system road 5S09 crosses the North Fork San Jacinto River. This point will allow sampling of a watershed containing a small piece of Alondale, Pine Wood, the Mount San Jacinto State Wilderness, Forest Service system campgrounds, Highway 243, and Forest Service system roads (Figure A).

***Determine the sources of information available***

This will be an ongoing activity done in coordination with the RWQCB. Consolidation of monitoring data from the Cranston gage, other sampling such as Lake Hemet, along with an internal search of District and Forest personnel collecting data for other purposes (e.g. fish and amphibian surveys, post-fire monitoring, BMP monitoring) will be conducted. Lessons learned will be incorporated to further reduce costs and increase efficiency.

The Nutrient TMDL and Addendum Staff Report (December 2004) contains the following information regarding the total phosphorous loading from the San Bernardino National Forest. Much of this information was modeled. This study will provide more data into the accuracy of the assumptions used in the model and the final results.

SCENARIO (% OF YEARS)	EXISTING LOADS	WEIGHTED TOTAL
Wet year (16%)	12,093 kg/yr	1,934.9 kg/yr
Moderate year (41%)	315 kg/yr	129.2 kg/yr
Dry year (43%)	196 kg/yr	84.3 kg/yr
	Total	2,148.4 kg/yr

From this information, the RWQCB listed the overall existing load from National Forest lands as 2,144 kg/yr for total phosphorous.

The target level for total phosphorous was determined by using Binkley (2001) information of average phosphorous levels from western forests. Using 0.115 mg/l and

an average annual flow rate of 20 cfs, the average loading rate of 2,038 kg/yr was determined.

A 5% reduction from 2,144 kg/yr gives 2,037 kg/yr.

### ***Identify sampling and analysis methods that can meet the data requirements***

Field sampling equipment shall include instantaneous flow monitoring equipment, a combination meter for EC, TDS, pH, and temperature, and soil nitrogen-phosphorous kits.

In order to limit the possibility of problems combining data from different laboratories, the SBNF has agreed to use Babcock Labs for the TMDL sample analysis. The Forest Service will maintain QA/QC requirements by using the QAPP produced in conjunction with the LE/CL TMDL Task Force and the San Jacinto River Watershed TMDL Water Monitoring guidance (Nov. 2002) provided by the Riverside County Flood Control District.

## **Step 4: Define the Study Boundaries**

### ***Define the target population of interest***

The target population of interest is total phosphorous as defined in the TMDL. A limited list of parameters will be collected at these sampling sites as detailed above. As this study is not focused on TMDL compliance, the more limited list of parameters is justified.

### ***Define the spatial boundaries that clarify what the data must represent***

### ***Identify any practical constraints on data collection (location, safety, weather, etc)***

As discussed above, the spatial boundaries of the study consist of Forest Service lands on the San Bernardino National Forest, San Jacinto Ranger District. The main concern for sampling, as with all Forest Service activities is safety. For this special study, sampling will not be occurring during stormy conditions, but taking samples every 2 months will require some access issues to be contemplated during the winter when vehicular access could be compromised by snow. For the eight (8) water sampling sites discussed above, access should not be much of an issue, because in most cases the sampling will be

accomplished near a paved road surface. The locations where the Forest Service land intersects Strawberry Creek both upstream and downstream of Idyllwild do require short off-road hikes, which could present visibility and slipping hazards during sampling.

### ***Define the time frame for collecting data and making the decision***

Samples should be taken as soon as the weather allows the Forest Service to establish the GPS locations of the sample sites and to collect baseline conditions of water in the creeks. Once sampling begins, future Federal Fiscal Year (FFY 2007) sampling will require data collection during the same months for future statistical seasonality calculations.

Quality Assurance/quality control samples (e.g. duplicates, blanks, etc) will be required at levels specified to ensure compliance with the QAPP and ensure that the laboratory used meets data quality standards.

### ***Determine the smallest subpopulation, area, volume or time for which separate decisions must be made***

Given the time frame before the next update of the TMDL and coinciding with the development of the Forest Nutrient Management Plan (Task 8) it is contemplated that the study will encompass one to two-and-a-half years. Annual reports will be submitted showing the laboratory results. To satisfy the assumptions inherent in the Central Limit Theorem, a statistically defensible analysis will not be available until at least nine (9) data points have been taken at each sampling location.

## **Step 5: Develop a Decision Rule**

As our objective for this special study is to compare downgradient locations to upgradient and background conditions to determine if there is a statistically significant increase above the upgradient or background condition, the EPA (2002) suggests that an Action Level need not be specified. Rather, the Action Level is implicitly defined by the upgradient or background concentration levels and the variability in the data. A summary of methods for determining background concentrations is available from numerous sources (EPA 2002).

## **Step 6: Specify Limits on Decision Errors**

Statistical data analysis will be performed using documentation published in various guidances (Conover, 1999; EPA, 1988; EPA, 1992; Gibbons, 1994; Gilbert, 1987; Helsel

and Hirsch, 1995; Taylor, 2003). Both parametric and nonparametric analyses will be used depending on the outcome of the samples collected and evaluated. The tests performed will include, but are not limited to, the following:

- Exploratory data analysis (mean, standard deviation, box plots, etc)
- Seasonality check (Kruskal-Wallis)
- Temporal trends (Mann-Kendall, 1975)
- Normality or log-normality (Shapiro-Wilk, 1965)
- Determine the appropriateness of using tolerance limits or prediction limits to determine the best estimate of the mean in the upstream and downstream location
- Compare upstream to downstream to see if there is a statistically defensible change in concentration between the two points.

### ***Identify potential sources of variability and bias in the sampling and measurement processes***

From EPA (2000):

The possibility of a decision error exists because the parameter of interest is estimated using data that are never perfect but are subject to different variabilities at different stages of development, from field collection to sample analysis. The combination of all these errors is called “total study error,” and for sampling, this can be broken down into two main components:

(1) **Sampling design error.** This error (variability) is influenced by the sample collection design, the number of samples, and the actual variability of the population over space and time. It is impractical to sample every unit of the media, and limited sampling may miss some features of the natural variation of the constituent concentration levels. Sampling design error occurs when the data collection design does not capture the complete variability within the media to the extent appropriate for the decision of interest.

(2) **Measurement error.** This error (variability) is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data reduction.

### ***Determine the possible range on the parameter of interest.***

Cranston gage data used in Tetra Tech analysis: 33 data: TP (mg/L): mean = 0.50, median = 0.36, range = 0.05 – 2.70

### ***Consider the consequences of making an incorrect decision.***

When hypothesis testing is applied to site assessment decisions, the data are used to choose between a presumed baseline condition of the environment and an alternative

condition. The test can then be used to show either that the baseline condition is false (and therefore the alternative condition is true) or that there is insufficient evidence to indicate that the baseline condition is false (and therefore the site manager decides by default that the baseline condition is true). The burden of proof is placed on rejecting the baseline condition, because the test-of-hypothesis structure maintains the baseline condition as being true until overwhelming evidence is presented to indicate that the baseline condition is not true.

A decision error occurs when the limited amount of data collected leads the site manager to decide that the baseline condition is false when it is true, or to decide that the baseline condition is true when it is really false. These two types of decision errors are classified as a false rejection error and a false acceptance error, respectively. In some circumstances, a false rejection error is known as a false positive error, and a false acceptance error as a false negative error. In statistical language, the baseline condition is called the null hypothesis ( $H_0$ ) and the alternative condition is called the alternative hypothesis ( $H_a$ ). A false rejection decision error occurs when the decision maker rejects the null hypothesis when it is really true; a false acceptance decision error occurs when the decision maker fails to reject the null hypothesis when it is really false.

## **Chapter 2 (Classic Storm-based TMDL data collection)**

### **Step 1: State the Problem**

**Purpose:** To define the problem so that the focus of the study will be unambiguous.

#### ***Identify members of the planning team***

- SBNF Forest Hydrologist: Sampling and Analysis Plan (SAP) primary author, coordinator, data collection, statistical data analysis and conclusions
- Lands, Minerals, and Resources Staff Officer on San Bernardino National Forest  
Resources Staff Officer on Cleveland National Forest
- Region 5 Regional Hydrologist
- SBNF Forest Aquatic biologist: consultant on locations of groundwater dependent ecosystems and aquatic resources, intermediary with State Fish & Game and Fish & Wildlife Service about emergency consultation (50 CFR 402.05), labs used, lab standards, other QA/QC
- Zone Soil Scientist: consultant on monitoring parameters relative to natural constituents and processes in the watershed in question
- Forest Supervisor: line officer, post study decision maker

#### ***Primary Decision Maker***

The San Bernardino National Forest Supervisor with consultation from team members: following data analysis, the results will be returned to the Forest Supervisor. If problems are identified or future work is needed, then the Forest Supervisor will make that decision and justify future work.

#### ***Concise Problem Statement***

Can a location be found for compliance monitoring that encompasses a sufficient land area to have a wide cross-section of Forest Service land management practices while limiting the land area under the jurisdiction of others? How does the information collected at this separate compliance location coordinate with the data collected at/near the USGS Cranston gaging station?

#### ***Background Site Conditions***

Discussed in Chapter 1:

The San Bernardino National Forest, San Jacinto Ranger District falls within the regulatory control of the Santa Ana Regional Water Quality Control Board (RWQCB) on the west and the Colorado River Regional Water Quality Control Board on the east.

There are three 5<sup>th</sup> Field watersheds in the San Jacinto Ranger District that discharge water towards Canyon Lake and Lake Elsinore.

- Upper San Jacinto, #1807020202
- Garner, #1807020201
- Bautista, #1807020203

The surficial geology of the San Jacinto Ranger District is comprised primarily of Mesozoic granitic rocks and alluvium.

Chapter 1 detailed that for the Upper San Jacinto watershed only 75% of the land area is under the regulatory control of the SBNF and some of the private in-holdings are right in the vicinity of the Cranston gaging station. The SBNF has concluded that the information gathered at the Cranston gaging station may be influenced by the agricultural/orchard land use near the gage as well as the possible influence of Strawberry Creek, which drain Idyllwild. Therefore, the SBNF has concluded that a separate compliance point should be used to monitor the multiple use nature of the forest. In order to do an adequate comparison, and to satisfy a condition of the LE/CL TMDL Task Force, the Forest Service will also conduct TMDL compliance monitoring at a location on Forest Service land in close proximity to the USGS Cranston gaging station.

### ***Determination of Resources***

<b>Laboratory Anlaysis Costs (June 2006 – Sept 2006)</b>	
Cost per sample (Babcock Labs)	\$200
# of Sites	2
# of storm measurements (8/storm)	16 (if applicable)
Total samples collected (with QA/QC)	18
<b>Total Analysis Costs for FFY2006</b>	<b>\$3,600</b>

Estimated Personnel and Equipment costs for FFY2006: \$1,500

**Estimated Total Study Costs for FFY2006: \$5,100**

<b>Laboratory Anlaysis Costs (Oct 2006 – Sept 2007)</b>	
Cost per sample (Babcock Labs)	\$200
# of Sites	2
# of storm samples (8/storm, 3 storms)	48
Total samples collected (with QA/QC)	54
<b>Total Analysis Costs for FFY2006</b>	<b>\$10,800</b>

Estimated Personnel and Equipment costs for FFY2007: \$6,300

**Estimated Total Study Costs for FFY2007: \$17,100**

## Step 2: Identify the Decision

### ***Principle Study Question***

What location(s) could provide compliance monitoring station(s) on the San Bernardino National Forest that will give an adequate measure of Forest Service land management practices but exclude effects from private in-holdings and other non-Forest Service regulated activities?

### ***Alternative Actions & Decision Statements***

- If a location is found that contains a cross-section of Forest Service land management activities that does not include land from private in-holdings and other non-Forest Service regulated activities, then
  - In consultation with the RWQCB designate this/these location(s) as compliance/trend monitoring stations and determine the on-going monitoring requirements
- If a location cannot be found that contains a cross-section of Forest Service land management activities or contains a cross-section of Forest Service land management activities along with some private in-holdings and other non-Forest Service regulated activities, then
  - In consultation with the RWQCB determine what percentage of the measured concentration from those locations can be reasonably attributed to Forest Service land management activities.
  - If reasonable, coordinate with the RWQCB and parties responsible for other in-holdings to establish sampling and monitoring requirements
- In either case, work with RWQCB to establish the correlation between the data collected at the location in question and the USGS Cranston gage to establish the empirical relationship between the two.
  - Through this empirical relationship, determine what portion of phosphorous monitored at the nearest watershed wide gage is reasonably attributed to the Forest Service and what portion is not associated with Forest Service regulated activities (private in-holdings such as Idyllwild or Lake Hemet). Then, in consultation with the RWQCB, the agencies responsible for the activities will be notified and the responsibility for the phosphorous loading will fall under the regulatory purview of the RWQCB.

## **Step 3: Identify Inputs to the Decision**

### ***Information required to resolve decision statements***

In the *Lake Elsinore and Canyon Lake Nutrient TMDL*, the RWQCB has identified applicable parameters for watershed monitoring consistent with those historically sampled in the watershed. Collection and analysis is recommended for a minimum of three storms per year and for eight samples over each hydrograph, though direction is not given as to how to decide which storms should be sampled. The SBNF will choose storms using the protocols used by Riverside County Flood Control District in consultation with the RWQCB. Sampling is not required during dry periods. The following parameters are recommended for measurement:

- Organic nitrogen
- Nitrite nitrogen
- Total phosphorous
- Total Hardness
- Total Suspended Solids
- Biological oxygen demand
- Ammonia nitrogen
- Nitrate nitrogen
- Ortho phosphate (SRP)
- Total dissolved solids
- Turbidity
- Chemical oxygen demand
- pH
- Water Temperature

The RWQCB further recommends in the nutrient TMDL that, at a minimum, daily flow determinations be made at all water quality monitoring stations. This information is being collected at the USGS Cranston gaging station, and in conjunction with stormflow data and bi-monthly data, an empirical relationship will be able to be assessed between the Cranston location and the chosen Forest Service compliance location on the North Fork of the San Jacinto River.

Robertson (2003) recommends that to reduce bias and get the best phosphorous loading result, one year studies should combine fixed period sampling with storm chasing, “even though loads were overestimated by 25 to 50%. For two to three-year load studies and estimating volumetrically weighted mean concentrations, fixed period semimonthly sampling” is a good choice. Though this study is anticipated to be at least 2 years in length, the Forest Service suggests that the combination sampling approach be used.

### ***Locations for sampling***

Best professional judgment was used in the determination of the sampling location used for compliance monitoring, giving weight to the locations of Forest Service regulated activities as well as private in-holding activities that are outside the regulatory authority of the Forest Service. Access was also looked at in the decision of applicable sampling sites. Prior to the first collection, these locations will be field verified and GPS locations will be recorded for future sample collection activities.

Preliminary investigation of land management practices and access indicates a sampling location: Lake Fulmor Quad Map, T4S R2E Section 33: Forest Service system road 5S09 crosses the North Fork San Jacinto River. This point will allow sampling of a watershed containing a small piece of Alondale, Pine Wood, the Mount San Jacinto State Wilderness, Forest Service system campgrounds, Highway 243, and Forest Service system roads (Figure A).

Following discussions with the LE/CL TMDL Task Force, the Forest Service agreed to conduct TMDL stormflow monitoring for the USGS Cranston gage, with the understanding that the actual sampling location will be on Forest Service lands in close proximity to the gage station.

### ***Determine the sources of information available***

This will be an ongoing activity done in coordination with the RWQCB and the LE/CL TMDL Task Force. Collection of other sources of data (e.g. sampling conducted by the Lake Hemet MWD, other stakeholders, Native American tribes, Forest Service personnel, ect) will be conducted. With limited budgets, the Forest Service will continue to investigate methods of reducing costs, including the use of voluntary and intern workers.

One aspect of data analysis will be to begin to assess the variability in phosphorous loading data, as well as assessing what lands are contributing to the existing loads. The current modeled forest/open space TMDL existing weighted load of 2,144 kg/yr of total phosphorous will be verified, if possible. An average annual flow rate will be tracked as well as the average annual concentration for various land uses. The target value of 2,037 kg/yr total phosphorous will be evaluated for its applicability to Forest Service lands as well as its applicability for use as a target at the chosen compliance point in the North Fork of the San Jacinto River.

### ***Identify sampling and analysis methods that can meet the data requirements***

Field sampling equipment shall include instantaneous flow monitoring equipment, a combination meter for EC, TDS, pH, and temperature, and soil nitrogen-phosphorous kits.

In order to limit the possibility of problems combining data from different laboratories, the SBNF has agreed to use Babcock Labs for the TMDL sample analysis. The Forest Service will maintain QA/QC requirements by using the QAPP produced in conjunction with the LE/CL TMDL Task Force and the San Jacinto River Watershed TMDL Water Monitoring guidance (Nov. 2002) provided by the Riverside County Flood Control District.

## **Step 4: Define the Study Boundaries**

### ***Define the target population of interest***

The target population includes the suite of parameters for storm based data to identify trends in total phosphorous. Data will be used for future modeling exercises to determine a more accurate distribution of loading from forest/open space land management practices.

### ***Define the spatial boundaries that clarify what the data must represent***

### ***Identify any practical constraints on data collection (location, safety, weather, etc)***

As discussed above, the spatial boundaries of this portion of the study consist of Forest Service lands on the San Bernardino National Forest, San Jacinto Ranger District in the vicinity of the Cranston gaging station and the intersection of the North Fork San Jacinto River with Forest Service system Road 5S09. The main concern for sampling, as with all Forest Service activities is safety. For this study, sampling will be occurring during stormy conditions, possibly at night. For the compliance point along 5S09, safety concerns include accessing the site by driving more than one (1) mile on a Forest Service dirt road and staying on-site during and after a rainstorm. The chosen storms for monitoring will need to be assessed ahead of time to make sure that the sampling is not being conducted for too large a storm. Until a landslide/debris flow assessment can be conducted on 5S09, the Forest Service will not put its employees or volunteers at risk of being stranded or hurt by geomorphic processes. Sampling during storms could also present visibility and slipping hazards. Protocols will need to be used to ensure that the collected samples do not get contaminated by precipitation during collection.

### ***Define the time frame for collecting data and making the decision***

Samples should be taken as soon as the weather indicates a sufficient storm that will influence flow from Forest Service lands. As stated above, there is the possibility that no storm of sufficient size will occur before the Federal Fiscal Year ends in September. Therefore, the three storms may be sampled in FFY2007. In either case, Forest Service emergencies (e.g. wildland fire) could preclude scheduled sampling from occurring.

Quality Assurance/quality control samples (e.g. duplicates, blanks, etc) will be required at levels specified to ensure compliance with the QAPP and ensure that the laboratory used meets data quality standards.

***Determine the smallest subpopulation, area, volume or time for which separate decisions must be made***

A critical look at land management patterns using GIS technology will be employed in the first 6 months of the plan. Given that the monitoring plan is not likely to gain approval until June 2006, the Forest Service suggests that a semi-annual report be delivered by December 2006 with the annual report in August of each year to start in 2007. The first report should have sufficient information regarding each of the data points being used as well as more precise information on the percentages of Forest Service regulated land is covered by each of the sampling stations.

## **Step 5: Develop a Decision Rule**

The Action Level for trend/storm/compliance monitoring points is defined by the current modeling analysis of the TMDL. The long term weighted average calculated load for forest/open space is listed as 2,144 kg/yr. A 5% reduction target gives a level of 2,037 kg/yr. Data collected at the trend/storm/compliance monitoring points will be evaluated using a maximum likelihood estimate for the mean and standard deviation of the data set. These estimates will be calculated when sufficient data is available. Loading calculations will be made using the hydrograph/pollutographs and estimates of duration and frequency of storms. An evaluation will be done on the inherent variability of the data to determine the likelihood of observing a 5% reduction in the collected data.

## **Step 6: Specify Limits on Decision Errors**

Statistical data analysis will be performed using documentation published in various guidances (Conover, 1999; EPA, 1988; EPA, 1992; Gibbons, 1994; Gilbert, 1987; Helsel and Hirsch, 1995; Taylor, 2003). Both parametric and nonparametric analyses will be used depending on the outcome of the samples collected and evaluated. The tests performed will include, but are not limited to, the following:

- Exploratory data analysis (mean, standard deviation, box plots, etc)
- Seasonality check (Kruskal-Wallis)
- Temporal trends (Mann-Kendall, 1975)
- Normality or log-normality (Shapiro-Wilk, 1965)
- Determine the appropriateness of using tolerance limits or prediction limits to determine the best estimate of the mean in the upstream and downstream location

- Compare upstream to downstream to see if there is a statistically defensible change in concentration between the two points.

### ***Identify potential sources of variability and bias in the sampling and measurement processes***

From EPA (2000):

The possibility of a decision error exists because the parameter of interest is estimated using data that are never perfect but are subject to different variabilities at different stages of development, from field collection to sample analysis. The combination of all these errors is called “total study error,” and for sampling at hazardous waste sites, this can be broken down into two main components:

(1) **Sampling design error.** This error (variability) is influenced by the sample collection design, the number of samples, and the actual variability of the population over space and time. It is impractical to sample every unit of the media, and limited sampling may miss some features of the natural variation of the constituent concentration levels. Sampling design error occurs when the data collection design does not capture the complete variability within the media to the extent appropriate for the decision of interest.

(2) **Measurement error.** This error (variability) is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data reduction.

### ***Determine the possible range on the parameter of interest.***

Cranston gage data used in Tetra Tech analysis: 33 data: TP (mg/L): mean = 0.50, median = 0.36, range = 0.05 – 2.70

### ***Consider the consequences of making an incorrect decision.***

When hypothesis testing is applied to site assessment decisions, the data are used to choose between a presumed baseline condition of the environment and an alternative condition. The test can then be used to show either that the baseline condition is false (and therefore the alternative condition is true) or that there is insufficient evidence to indicate that the baseline condition is false (and therefore the site manager decides by default that the baseline condition is true). The burden of proof is placed on rejecting the baseline condition, because the test-of-hypothesis structure maintains the baseline condition as being true until overwhelming evidence is presented to indicate that the baseline condition is not true.

A decision error occurs when the limited amount of data collected leads the site manager to decide that the baseline condition is false when it is true, or to decide that the baseline

condition is true when it is really false. These two types of decision errors are classified as a false rejection error and a false acceptance error, respectively. In some circumstances, a false rejection error is known as a false positive error, and a false acceptance error as a false negative error. In statistical language, the baseline condition is called the null hypothesis ( $H_0$ ) and the alternative condition is called the alternative hypothesis ( $H_a$ ). A false rejection decision error occurs when the decision maker rejects the null hypothesis when it is really true; a false acceptance decision error occurs when the decision maker fails to reject the null hypothesis when it is really false.

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