Draft Watershed and Sub-basin Planning Principles

San Juan/Western San Mateo Watersheds
Orange County, California

February 2003

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Orange County, California

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February 2003

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INTRODUCTION

The U.S. Army Corps of Engineers, Los Angeles District ("ACOE") and the California Department of Fish and Game ("CDFG") have previously prepared a set of general watershed tenets (planning framework) that was presented at the Southern Orange County Coordinated Planning Process public workshops on December 13, 2001 and May 15, 2002. As in the case of the Natural Community Conservation Planning Act (NCCP) Guidelines, the Natural Community Conservation Planning Act/Special Area Management Plan (NCCP/SAMP) working group has concluded that the preparation of a set of more geographically-specific planning principles will help provide focus for the Special Area Management Plan/Master Streambed Alteration Agreement (SAMP/MSAA) planning effort.

The draft SAMP/MSAA Watershed and Sub-basin Planning Principles for the San Juan/Western San Mateo Watersheds ("Planning Principles") provide a link between the broader SAMP/MSAA Tenets for protecting and conserving aquatic and riparian resources and the known, key physical and biological resources and processes that will be addressed in formulating the reserve program for the Southern Subregion SAMP/MSAA. The principles refine the planning framework tenets and identify the key physical and biological processes and resources at both the watershed and sub-basin level. These tenets and principles are to be the focus of the aquatic resources reserve and management program.

The Planning Principles are intended to provide an objective and common set of planning considerations and recommendations for use by the resource and regulatory agencies (in coordination with the program participants) in selecting and evaluating aquatic resource protection, restoration and management alternatives ("aquatic reserve program alternatives"). Other tools to be used by the regulatory agencies in selecting and evaluating reserve program, restoration and management alternatives include the use of the Assessment of Riparian Ecosystem Integrity Model, as developed for the San Juan and San Mateo Creek Watersheds of Orange County, California, by R. Daniel Smith, Engineering, Research and Development Center, Waterways Experiment Station (2001). It is also recognized that alternatives will reflect other non-biological objectives, in keeping with the purpose and need of the SAMP/MSAA to provide "a comprehensive approach to protect and enhance aquatic and riparian resources while providing for reasonable economic development and public infrastructure in accordance with applicable local, state and federal laws." Accordingly, application of the planning recommendations is consistent with the Science Advisors recognition that the NCCP Reserve Design Principles are not absolutes and "that it may be impractical or unrealistic to expect that every design principle will be completely fulfilled throughout the subregion" (Science Advisors, May 1997).

The Planning Principles represent a synthesis of the following sources:

- The Southern Subregion SAMP/MSAA tenets.
- The ACOE' Watershed Delineation and Functional Assessment reports.
- The Baseline Geomorphic and Hydrologic Conditions Report, and associated technical reports, prepared by Balance Hydrologics (BH), PCR Services Corporation (PCR) and Phillips Williams & Associates (PWA) for Rancho Mission Viejo (RMV).
- Reserve Design Principles (1997) prepared by the Science Advisors for the Southern Subregion NCCP.
- Southern Subregion data bases.

The principles do not: 1) commit to conserve or allow impacts to specific biological and hydrological resources; or 2) discount resources that are not identified specifically. As the public preparation and review process for the SAMP/MSAA continues, it is anticipated that new planning information and analyses could modify the assessment of the significance of specific resources, including the initial planning recommendations. Thus the specific language in the Planning Principles will continue to be reviewed and modified as appropriate.

Relationship of Principles to Other Planning Program Criteria

Importantly, the Planning Principles provide a key link between the SAMP/MSAA and the Natural Community Conservation Planning Act/Habitat Conservation Plan (NCCP/HCP). Recognizing the significance of watershed physical processes, the Science Advisors combined two of the 7 reserve design tenets originally formulated by the NCCP Scientific Review Panel and added a new Tenet 7. This new tenet of reserve design ("Maintain Ecosystem Processes and Structures") was directed in significant part toward protecting to the maximum extent possible the hydrology regimes of riparian systems. The fundamental hydrologic and geomorphic processes of the overall watersheds and of the sub-basins not only shape and alter the creek systems in the planning area over time but also play a significant role in influencing upland habitat systems. The ACOE and consultant reports both address biologic, hydrologic and geomorphic processes and resources. The ACOE report focuses its assessment at the riparian reach (segment)-level of the watershed, although it also integrates adjacent landscape conditions. The consultant reports address both broader watershed level processes and terrains and the distinct biologic, geomorphic and hydrologic characteristics of each sub-basin. Together, these reports provide important information that is necessary to identify and understand the key processes and resources of the watersheds and sub-basin and their relationship to upland processes and resources consistent with the SAMP/MSAA Tenets and Tenet 7 of the Science Advisors' reserve design principles.

The hydrologic "sub-basin" has been selected as the geographic planning unit because it is important to focus on the distinct biologic, geomorphic and hydrologic characteristics of each sub-basin while formulating an overall reserve program. For each sub-basin, the important hydrologic and geomorphic processes and aquatic/riparian resources are identified and reviewed under the heading of "planning considerations" which are then followed by protection and enhancement/restoration recommendations under the heading of "planning recommendations." It is important to understand that the NCCP Guidelines and Planning Principles will not always treat the same biologic and hydrologic resources in the same manner. Use of common sub-basin planning units enables program participants and the public to identify and address those instances where the different approaches and priorities inherent in the NCCP and SAMP programs create the need for reconciliation of differing protection and management recommendations.

Format of Document

Section 1 of this document contains materials intended to provide basic planning principles that can be used throughout the planning area, and is divided the SAMP/MSAA Tenets and those principles derived from the Baseline Conditions Report as follows:

- Section 1A contains the SAMP Tenets prepared by the ACOE.
- Section 1B contains a set of Baseline Conditions Watershed Planning Principles intended to summarize key considerations and principles identified in the Baseline Report and supporting field observations.
- Section 1C contains a series of maps designed to spatially represent the watershed-scale terrains and hydrology considerations from the Baseline Conditions Report.
- Section 1D describes the relationship between the SAMP Tenets and the Planning Principles in formulating and evaluating alternatives.

Section 2 of this document presents a number of considerations and recommendations at the Sub-Basin scale in order to identify key planning principles that both reflect and address the distinctive characteristics of the sub-basins. Each sub-basin description includes:

- A summary of the ACOE's Waterways Experiment Station (WES) studies observations (as interpreted by RMV consultants and not reflective of official ACOE guidance and policy).
- Maps of the hydrology, water quality and habitat integrity for each sub-basin as mapped by the ACOE.

- A summary of the Significant Terrains and Hydrology Features for planning consideration in the sub-basin.

- A summary of Planning Recommendations for the sub-basin.

- A set of maps and aerial photos highlighting both Significant Terrains and Hydrology Features and Planning Considerations from the Baseline Report.

Relationship to Species Downstream and Outside the Planning Area

In addition to the listed and other selected planning species that occur within the Southern Subregion and the hydrologic/sediment resources occurring within the Orange County portions of the San Mateo Creek watershed, other listed species and hydrologic resources of significance occur downstream of the planning area. Potential downstream impacts and mitigation measures will be addressed in the California Environmental Quality Act/National Environmental Policy Act documents for the NCCP/HCP and SAMP/MSAA. From a SAMP/MSAA perspective, potential downstream impacts will be considered from a terrains, hydrology and water quality perspective. This consideration will include information regarding watershed processes gained in formulating the Planning Principles.

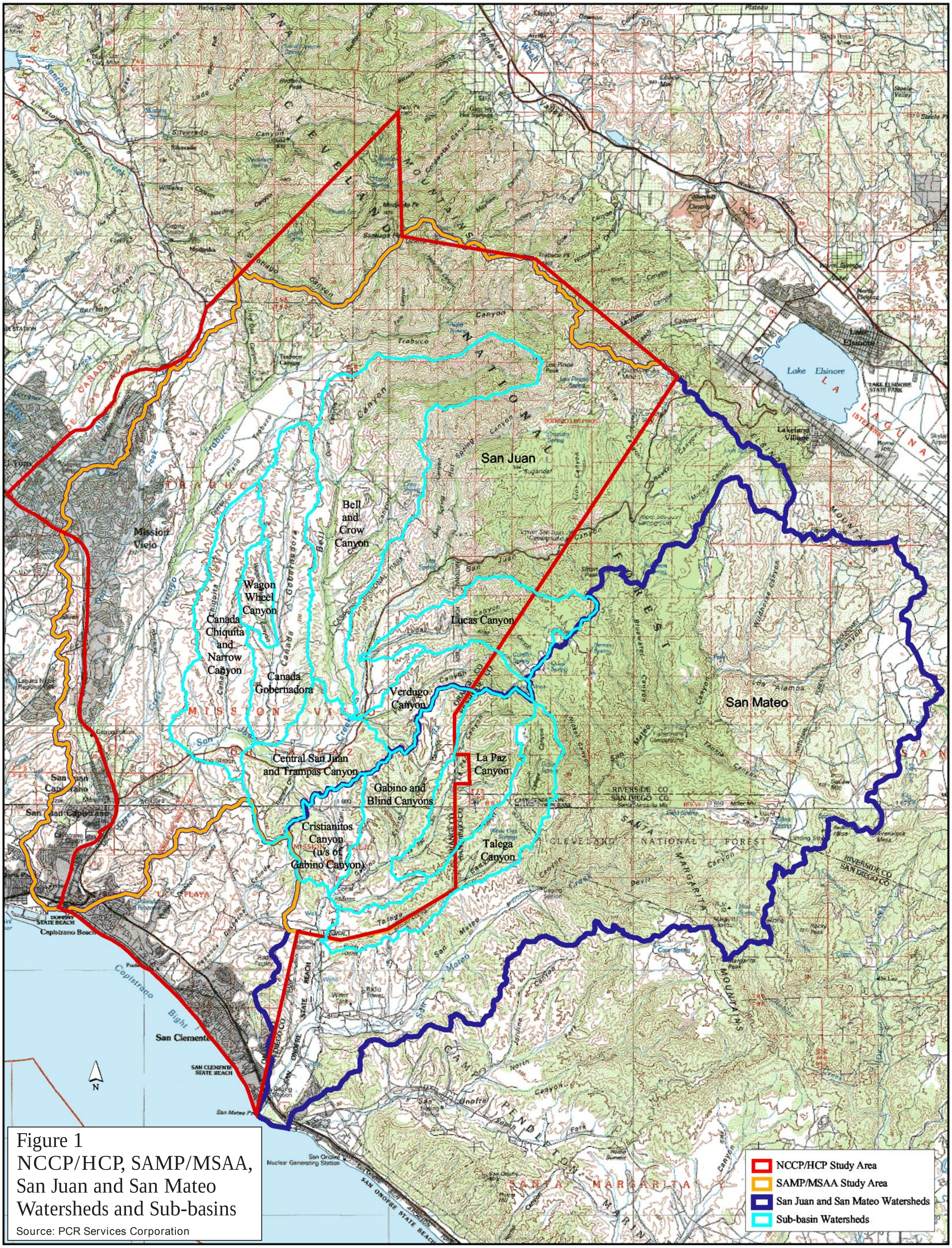

Figure 1
NCCP/HCP, SAMP/MSAA, San Juan and San Mateo Watersheds and Sub-basins

Source: PCR Services Corporation

Figure 2
Sub-basin Watersheds

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SECTION 1: WATERSHED LEVEL PLANNING TENETS AND PRINCIPLES

The following Tenets and Principles are intended to be applied at the watershed scale. For reference the boundaries of the San Juan Creek and San Mateo Creek watersheds within the study area and the boundaries of each sub-basin are provided.

1A. SAMP TENETS

The following tenets were presented by the ACOE at the December 13, 2001 Alternatives Workshop and further expanded upon at the May 15, 2002 workshop.

i. No net loss of acreage and functions of waters of the U.S./State

ii. Maintain/restore riparian ecosystem integrity

iii. Protect headwaters

iv. Maintain/protect/restore riparian corridors

v. Maintain and/or restore floodplain connection

vi. Maintain and/or restore sediment sources and transport equilibrium

vii. Maintain adequate buffer for the protection of riparian corridors

viii. Protect riparian areas and associated habitats of listed and sensitive species

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1B. BASELINE CONDITIONS WATERSHED PLANNING PRINCIPLES

The parenthetical references provided refer to the sections of the Baseline Conditions Report, or other technical reports, from which each principle or sub-part thereof was derived. The source documents contain the supporting data, analyses, and technical discussions.

i) Geomorphology/Terrains

Principle 1 – Recognize and account for the hydrologic response of different terrains at the sub-basin and watershed scale.

- Land use/resource planning (hereafter Planning) should recognize the following terrains characteristics: (1) "sandy" terrains favor the infiltration of stormwater and other surface flows and such terrains are particularly sensitive to significant changes in surface flow conditions; (2) "silty/sandy" terrains have higher runoff rates than sandy terrains and often contribute fine sediments during extreme runoff, with the potential for increases in downstream turbidity, but otherwise resemble sandy terrains more than clayey ones; (3) "clayey" terrains are characterized by very high surface runoff rates, with little contribution to groundwater infiltration; although typically resistant to erosion, where incision occurs, clay soils can be a significant source of fine sediments resulting in downstream turbidity impacts; and (4) "crystalline" terrains have high runoff rates during larger storms and produce much of the coarse sediments that move down the creek systems, thereby playing an important role in habitat systems affected by course sediment regimes *(Section 3.2.2, 4.1)*.

- Planning in sandy terrains should provide for setbacks from the mainstem channel in order to retain the infiltration capacity of the valley floor and protect the integrity of the mainstem channels and corridors. Planning should avoid the addition of significant impervious surfaces to major tributary side canyons and swales to the extent feasible. Planning should direct significant new impervious surfaces to areas characterized by relatively high runoff rates/low infiltration under existing conditions. Drainage from new impervious surfaces should, where feasible, be directed to major tributary side canyons for infiltration/detention. Drainage into major side canyons and swales must be accompanied by adequate detention/infiltration addressing the particular characteristics of sandy terrains *(Section 3.2.2.1 and 3.2.2.2)*.

- Planning in clayey terrains should attempt, to the maximum extent feasible, to emulate the runoff/infiltration characteristics of clayey terrains and to correct any existing erosion in clayey terrains contributing to downstream turbidity impacts. Channels in clayey and crystalline terrains are generally more resistant to erosion, incision and head cutting than those in sandy terrains. Restoration of native grasslands may be a strategy for existing grazing lands in headwaters and other appropriate areas to reduce surface erosion, increase stormwater infiltration and reduce downstream turbidity *(Section 3.2.2.1 and 3.2.2.2)*.

- Planning in crystalline terrains should provide for the protection of sources of coarse sediments (e.g., Verdugo Canyon).

- Although generalized terrains patterns can guide planning at a watershed scale, the specific characteristics of a given sub-basin should direct planning at the site-specific scale.

ii) Hydrology

Principle 2 – Emulate, to the extent feasible, the existing runoff and infiltration patterns in consideration of specific terrains, soil types and ground cover.

- Planning should consider existing rainfall infiltration and runoff processes in the context of terrains, land use, ground cover, soil types (e.g., sandy soils with high infiltration vs. clay soils with high runoff), basin size and shape, natural zones of high runoff (e.g., hard-pan caps), and natural infiltration areas (e.g., sandy swales) *(Section 3.2.2.)*.

- Planning should recognize and account for the inherent characteristics of each sub-basin's channel network as it relates to the particular terrains and infiltration/runoff characteristics of the sub-basin *(Sections 3.4.1.1-3.4.1.3, 3.4.2.1-3.4.2.3)*.

Principle 3 – Address potential effects of future land use changes on hydrology.

- Planning should address the following hydrologic considerations under future land use scenarios: (1) potential increases in dry season streamflow and wet season baseflow between storms; (2) changes in the magnitude, frequency, and duration of annually expected flow events (1~2 yr events); (3) changes in hydrologic response to major episodic storm events; (4) potential changes in sediment supply, with short term increases related to construction and longer term reductions related to impervious/landscaped ground cover; and (5) potential changes in the infiltration of surface/soil water to groundwater *(Sections 3.4.1.2, 3.4.1.3, 3.4.2.2, 3.4.2.3, 3.4.3, 4.2, PWA Appendix A, Hamilton, 2000 study on Muddy Canyon)*.

Principle 4 – Minimize alterations of the timing of peak flows of each sub-basin relative to the mainstem creeks.

- Planning should address the relationship between the timing of peak flows of each sub-basin in relation to peak flows through and along the mainstem creeks.[1] Instances where the relative timing of peak flows from tributary sub-basins coincides with those of the mainstem channel may result in amplification of flow rates, volumes, and associated sediment transport. Therefore, management of the timing of peak flows is important to safeguard downstream areas from the effects of increased frequency of high flows and sediment yields. The goal should be to not adversely alter the runoff interactions between the sub-basins and mainstem creeks in relation to peak flow characteristics identified in the Baseline Conditions Report *(Section 4.2, PWA Appendix A)*.

Principle 5 – Maintain and/or restore the inherent geomorphic structure of major tributaries and their floodplains.

- Land use and restoration should be planned in the context of the nature of the mainstem channel and its associated floodplains, flow characteristics, terraces and important surface and sub-surface drainage systems. Land planning should consider channel form (e.g., well-defined single channel, meandering channel, braided channel system) in relation to governing physical processes in the sub-basin, including terrains and groundwater. To the extent possible, the role of long-term geologic processes needs to be differentiated from localized processes influenced by specific land uses *(Section 3.2, BH Appendix C, fundamental geomorphology)*.

- Planning should consider the role of longer-term wet/dry cycles and how such cycles influence hydrologic conditions. The role of major episodic storm events in transporting sediment, re-organizing channel/floodplain structure, and re-generating riparian plant communities should also be considered *(Section 3.3.1, 3.3.2, 3.5.2)*.

iii) Sediment Sources, Storage and Transport

Principle 6 – Maintain coarse sediment yields, storage and transport processes.

- Planning should take into account the volume and grain size of sediment generation occurring within the terrains specific to each sub-basin. In general, sandy and crystalline terrains will produce coarse sediments that may be important for

[1] *Timing of peak flows from tributary sub-basins is governed by the size, shape, geology, and soils of the sub-basin, the sub-basin's position in the watershed, as well as land use/cover in the sub-basin.*

downstream channel structure and habitat. Clayey terrains will produce fine sediments that may be associated with increased turbidity in downstream areas *(Sections 3.5.1, 3.5.3.1, 3.5.3.2, Table 10, Table 11).*

- Planning should maintain sediment transport and storage processes between hillslope, tributaries, sub-basin channels and mainstem creeks.

- Planning should maintain the geomorphic characteristics of streambeds, including maintaining the supply and transport of sediment types that are important to aquatic habitat systems (e.g., sand, gravel, cobbles).

- Planning should maintain significant sediment transport and storage processes in: (a) central San Juan Creek which transports coarse sediments from the upper San Juan watershed, Bell Canyon and Verdugo Canyon to downstream areas; and (b) middle and lower Gabino Creek and Cristianitos Creek downstream of the Gabino/Upper Cristianitos confluence containing areas with coarse textured channel beds and over-bank terraces supporting important aquatic habitats *(Sections 3.5.3.1, 3.5.3.2, 6.1.4, 6.2.3)*.

- Planning should assure that major new detrimental sources (or sinks) of sediment are not created. New sources can result from either causing new locations for sediment generation or mobilizing sediment through accelerating existing erosional areas or initiating sedimentation from recently inactive areas such as landslides. Particular attention must be paid to avoiding creating new sources of in-channel sediment generation resulting from channel incision *(Section 3.5, 4.4, Trimble 1998 San Diego Creek Study)*.

- Planning should attempt, to the extent feasible, to address existing sources of sediment, or deficits of sediments, that may be detrimental to the streams systems. Such sources may include increased fine sediment yields from upper Cristianitos Creek and upper Gabino Creek *(Sections 3.5, 4.4, 6.2.1, 6.2.3)*.

iv) Groundwater Hydrology

Principle 7 – Utilize infiltration properties of sandy terrains for groundwater recharge and to offset potential increases in surface runoff and adverse effects to water quality.

- Planning should take advantage of the infiltration opportunities associated with sandy terrains to offset potential effects of changes in surface runoff and water quality associated with existing and future land uses and groundwater extractions. In particular, unlike many of the other areas in southern Orange County, the sandy portions of the central San Juan watershed are moderately permeable and provide significant groundwater recharge and infiltration opportunities *(Sections 3.2.2, 3.7)*.

Principle 8 – Protect existing groundwater recharge areas supporting slope wetlands and riparian zones; and maximize groundwater recharge of alluvial aquifers to the extent consistent with aquifer capacity and habitat management goals.

- Planning should take into account and provide for the differences in character and function of groundwater recharge areas in specific sub-basins. Groundwater recharge characteristics are influenced by surface and sub-surface geology and hydrology, with significant differences in duration and areal extent of groundwater flows. Some canyons support perennial or near-perennial flow because: (a) their sandy watersheds support higher rates of recharge; (b) shallow aquifers perched on restrictive clay beds occur widely beneath their valley floors; and/or (c) discharge occurs from existing residential communities (Gobernadora) or industrial activities (Trampas). Other canyons sustain flows for only weeks or a month or two following the end of spring rains, because the properties of the bedrock do not enable movement of substantial volumes of water from beneath the slopes into the creek. Plans should recognize the distinctive aquifer properties, and enable the hydrogeologic system to function such that it helps support protected and future wetland or riparian habitat *(Sections 3.7, 4.3)*.

- Planning should explore opportunities to utilize urban-generated runoff that has been treated in natural water quality systems for aquifer recharge. For example, future increases in urban-generated runoff could provide aquifer re-charge opportunities to offset the effects of ongoing groundwater extraction from the San Juan Creek aquifer on riparian habitat during low rainfall years *(Section 5.1)*.

- Planning should anticipate the need to maintain infiltration and groundwater recharge in the main valleys of Chiquita and Gobernadora Sub-basins and in their wide and sandy, tributaries in order to maintain groundwater levels important for sustaining creek flows and associated wetlands and riparian habitats. Groundwater derived from beneath the hill slopes and ridges is a significant element of the sub-basin and creek system hydrology of the Chiquita and Gobernadora Sub-basins. Based on current understanding, historic lakebed deposits that formed during the recession of sea level provide a barrier to subsurface water movement out of the Chiquita and Gobernadora Sub-basins into the San Juan Creek aquifer. It is likely that water levels in the alluvium of these two streams are, at least in large part, isolated from groundwater in the sands and gravels beneath San Juan Creek, and that the water tables in both valleys can be maintained during normal years at levels sustaining their riparian zones *(Sections 3.7, 6.1.1, 6.1.2)*.

- Planning should protect the relationship between subsurface water and the slope wetlands. Slope wetlands are supported by shallow subsurface water originating within landslides and other slope deposits, or (more commonly) by deeper bedrock aquifers *(Sections 3.7, 6.1.1, 6.1.2)*.

v) Water Quality

Principle 9 – Protect water quality by using a variety of strategies, with particular emphasis on natural treatment systems such as water quality wetlands, swales and infiltration areas and application of Best Management Practices within development areas to assure comprehensive water quality treatment prior to the discharge of urban runoff into the Habitat Reserve.

- Planning should account for the range of pollutant loadings and filtration functions associated with the specific terrains of each sub-basin. Sub-basins dominated by grasslands and/or used for grazing contribute nitrogen loading (e.g., Chiquita, Gobernadora, Gabino, Cristianitos); sub-basins with large quantities of erodible material provide sources of phosphorus loading (e.g., Lucas, Verdugo, Narrow); sub-basins with silty or clayey terrains can be sources of turbidity (e.g., Cristianitos, Upper Gabino); and sandy terrains encourage assimilation of pollutants to groundwater *(Section 3.6)*.

- Planning should provide for water quality treatment prior to the discharge of stormwater runoff into native or restored habitat areas or shallow groundwater systems. To the maximum extent feasible, water quality management for future land-use scenarios should rely on the use of "natural treatment systems" such as water quality wetlands, swales and infiltration areas described in Management Measures 6B and 6C of the State Nonpoint Source Plan (Plan for California's Nonpoint Source Pollution Control Program, July 2000). These systems should address both dissolved and particulate-bound pollutants. Where feasible, such natural treatment systems should maintain existing hydrologic patterns, including infiltration of treated waters into groundwater systems, and should not displace existing significant habitat. Natural treatment systems should be capable of treating dry season nuisance flows, non-storm wet season flows and 1-2 year storms *(Sections 3.6, 4.5)*.

  - Planning should consider restoration of upland vegetation and riparian habitat as a strategy, where appropriate, to reduce loadings from uplands, and increase assimilation of pollutants *(Sections 3.6, 4.5)*.

  - Planning should consider infiltration in conjunction with created wetlands and recharge ponds as another strategy to assimilate and transform pollutants as near to the source as possible. Such systems should protect existing shallow groundwater aquifers *(Sections 3.6, 4.5)*.

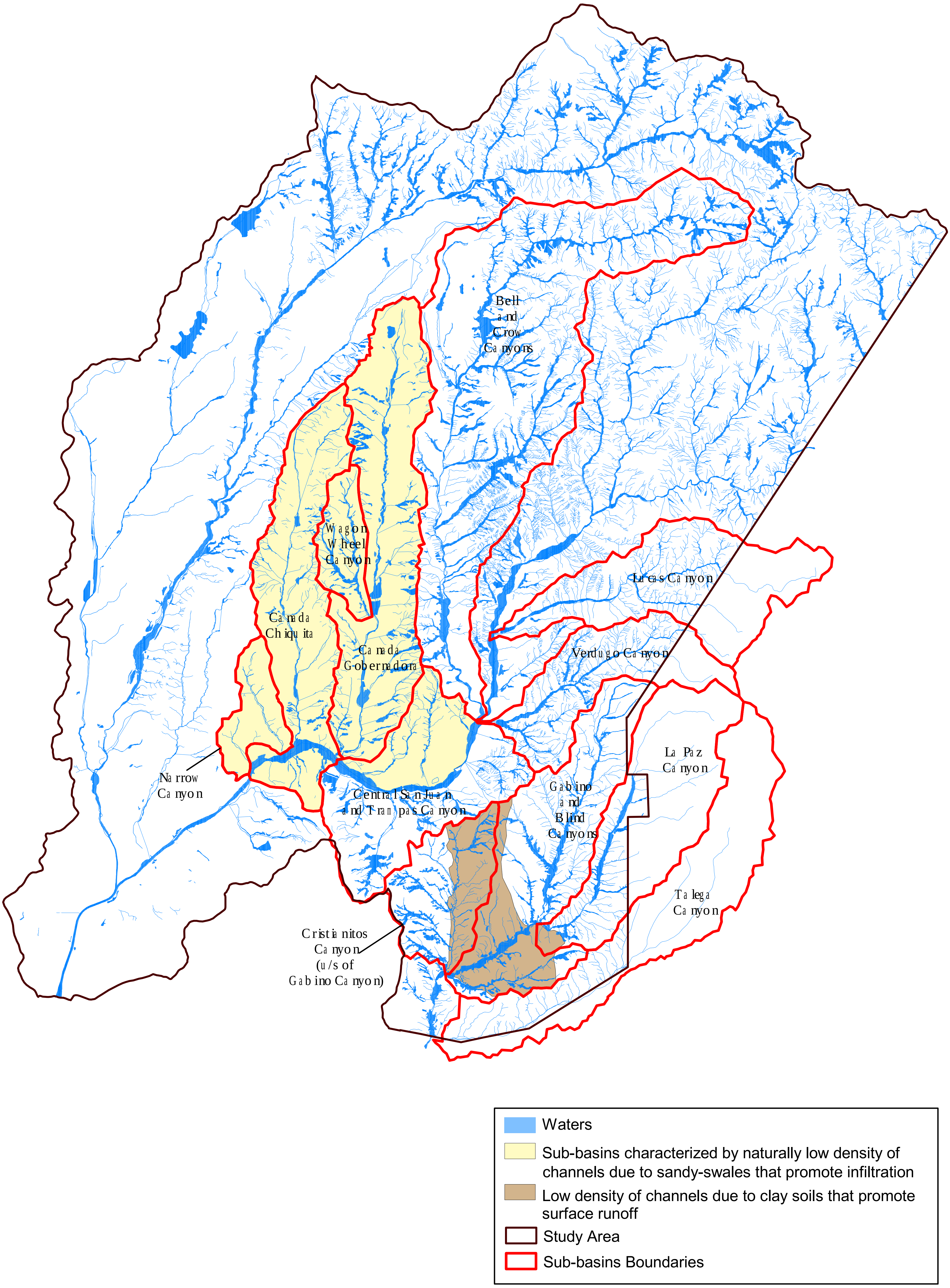
  - Planning should assess the need for changing agricultural practices to reduce nutrient loading consistent with applicable water quality requirements.

- Dry season and stormwater discharges under future land use scenarios should achieve appropriate levels of treatment for nutrients, metals, pathogens and other potential pollutants. Stormwater discharges should address the policies established by the San Diego Regional Water Quality Control Board and the County of Orange for purposes of preparing a Jurisdictional Urban Runoff Management Program pursuant to the Regional Board's Stormwater Program. Areas that contain aquatic habitats supporting sensitive aquatic species should receive particular attention and meet appropriate water quality requirements *(Sections 3.6, 4.5)*.

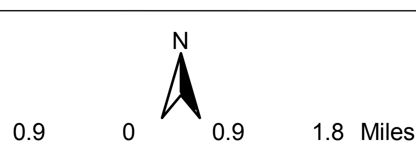
1C. SPATIAL REPRESENTATION OF WATERSHED SCALE TERRAINS AND HYDROLOGY PLANNING CONSIDERATIONS

The following series of maps were prepared by RMV consultants to spatially represent the indicated watershed considerations to facilitate discussions regarding watershed scale criteria:

- Areas with Low Density of Channels (Geomorphology & Terrains).
- Infiltration and Runoff (Geomorphology & Terrains).
- Timing of Peak Flows (Hydrology).
- Sediment Sources and Transport (Sediment).
- Groundwater Dependent Riparian Areas (Groundwater Hydrology).
- Geomorphic Terrains (Geomorphology and Terrains).
- Primary Geologic Formations Map/Bedrock Derived Baseflow (Groundwater Hydrology).
- Potential Sources of Nutrients and Turbidity (Water Quality).

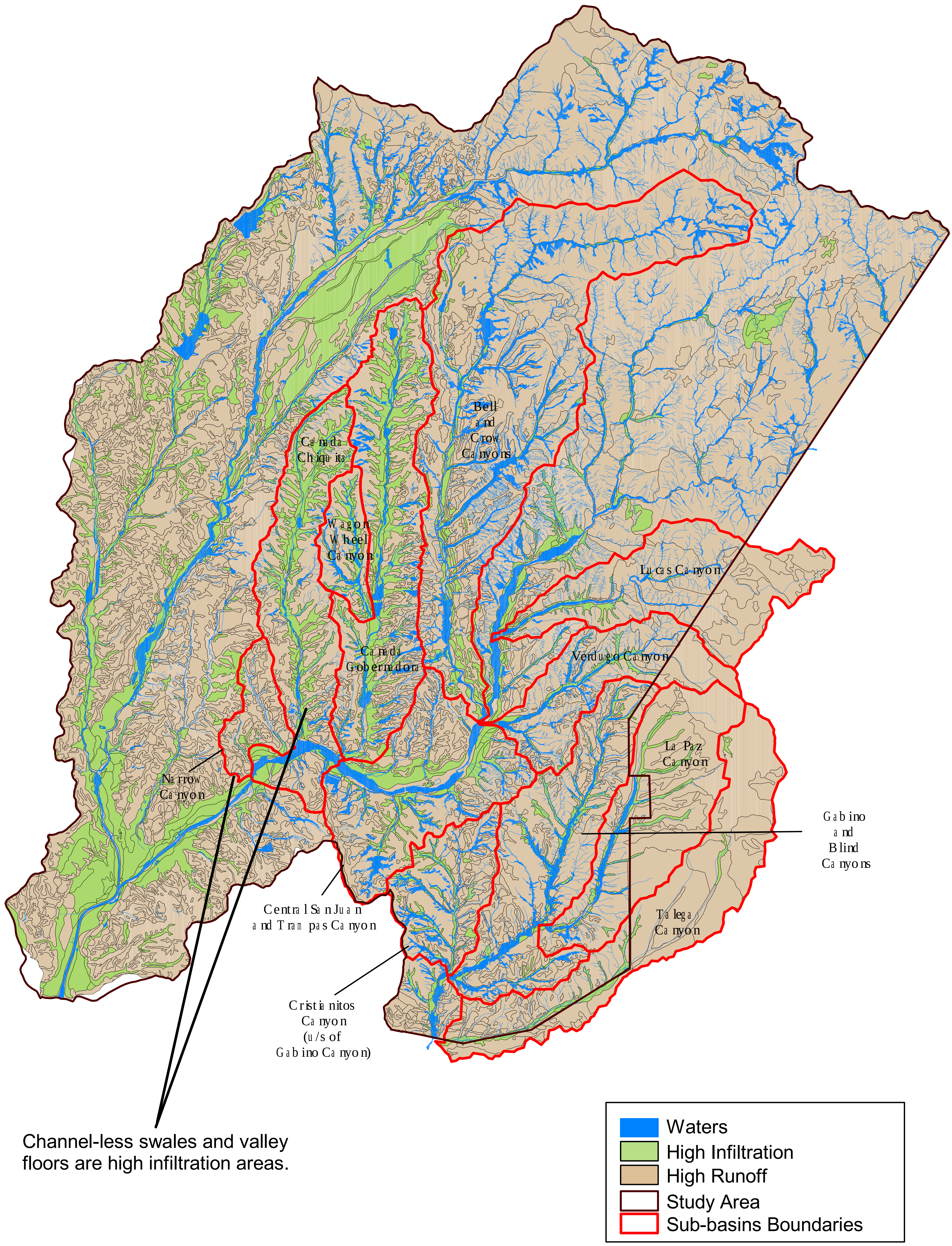


*Note: Channels equal areas with defined bed and bank features.



Source: ACOE 2000 and PCR 2002.

Figure 3
Baseline Conditions Report
Watershed Scale Considerations
Areas with Low Density of Channels*

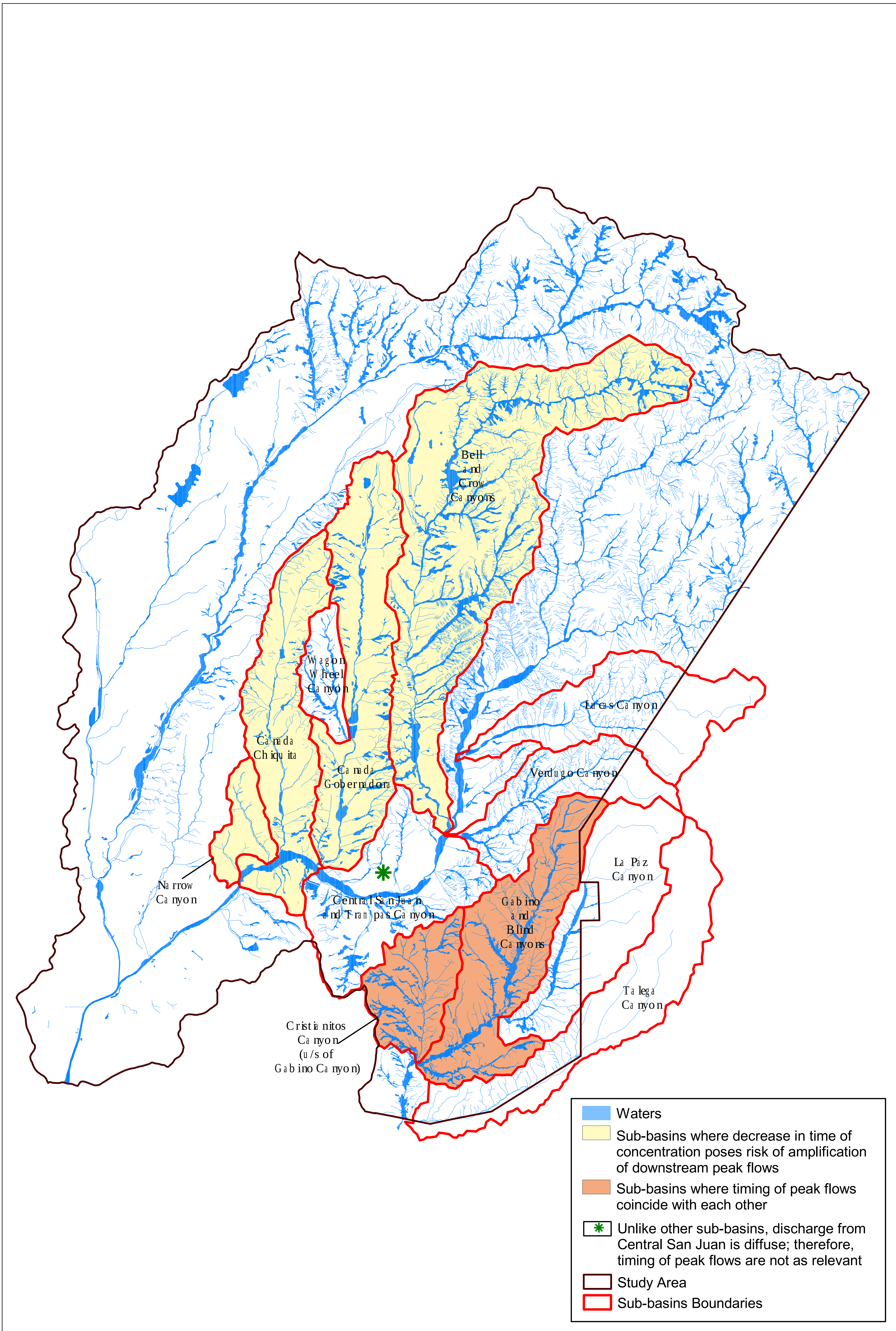


N

0.9 0 0.9 1.8 Miles

Source: ACOE, PWA 2000 and PCR 2002.

Figure 4
Baseline Conditions Report
Watershed Scale Considerations
Infiltration and Runoff



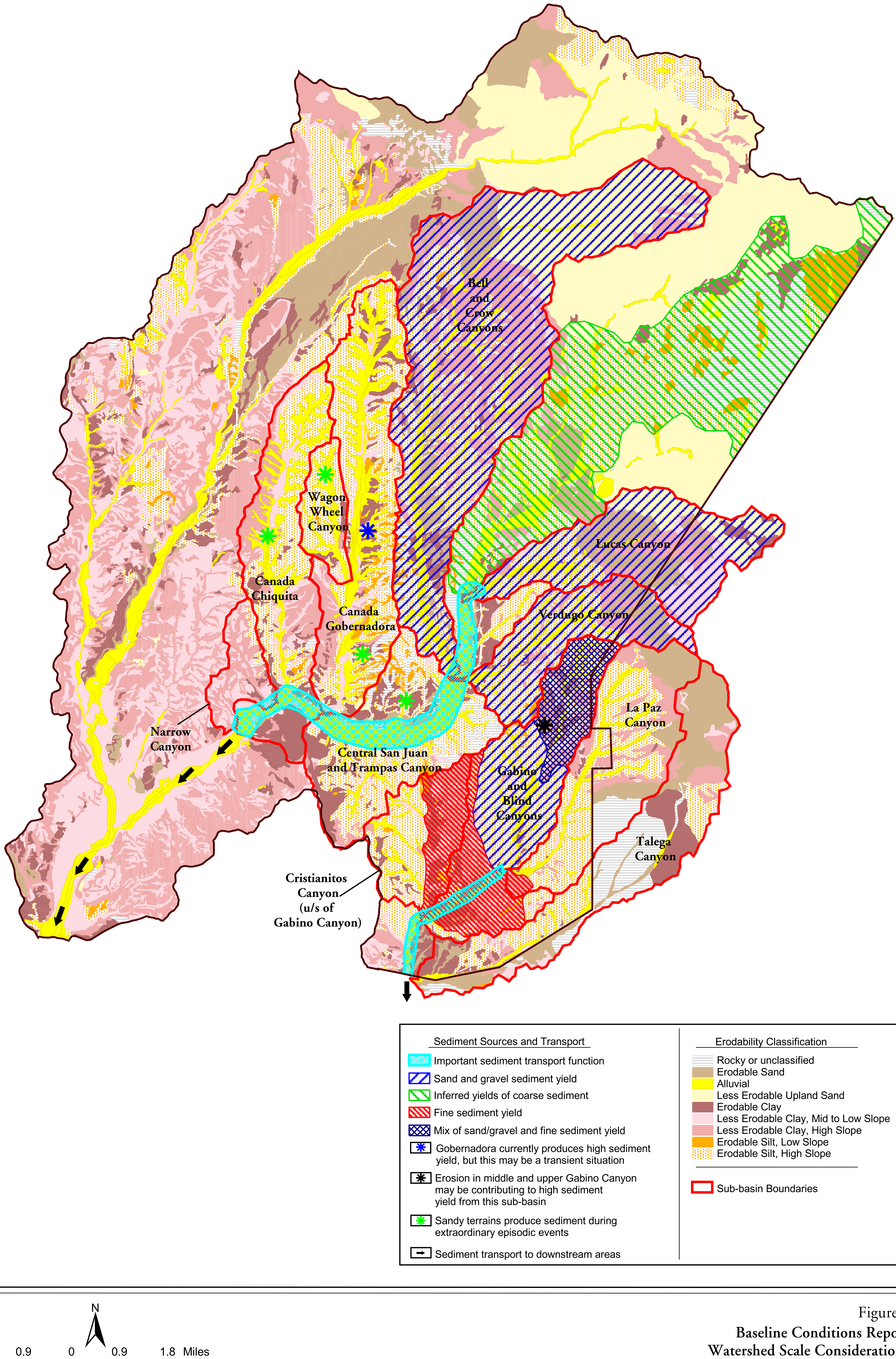
N

0.9 0 0.9 1.8 Miles

Source: ACOE, PWA 2000 and PCR 2002.

Figure 5

Baseline Conditions Report
Watershed Scale Considerations
Timing of Peak Flows



Source: ACOE, BH, PWA 2000 and PCR 2002.

Figure 6
Baseline Conditions Report
Watershed Scale Considerations
Sediment Sources and Transport

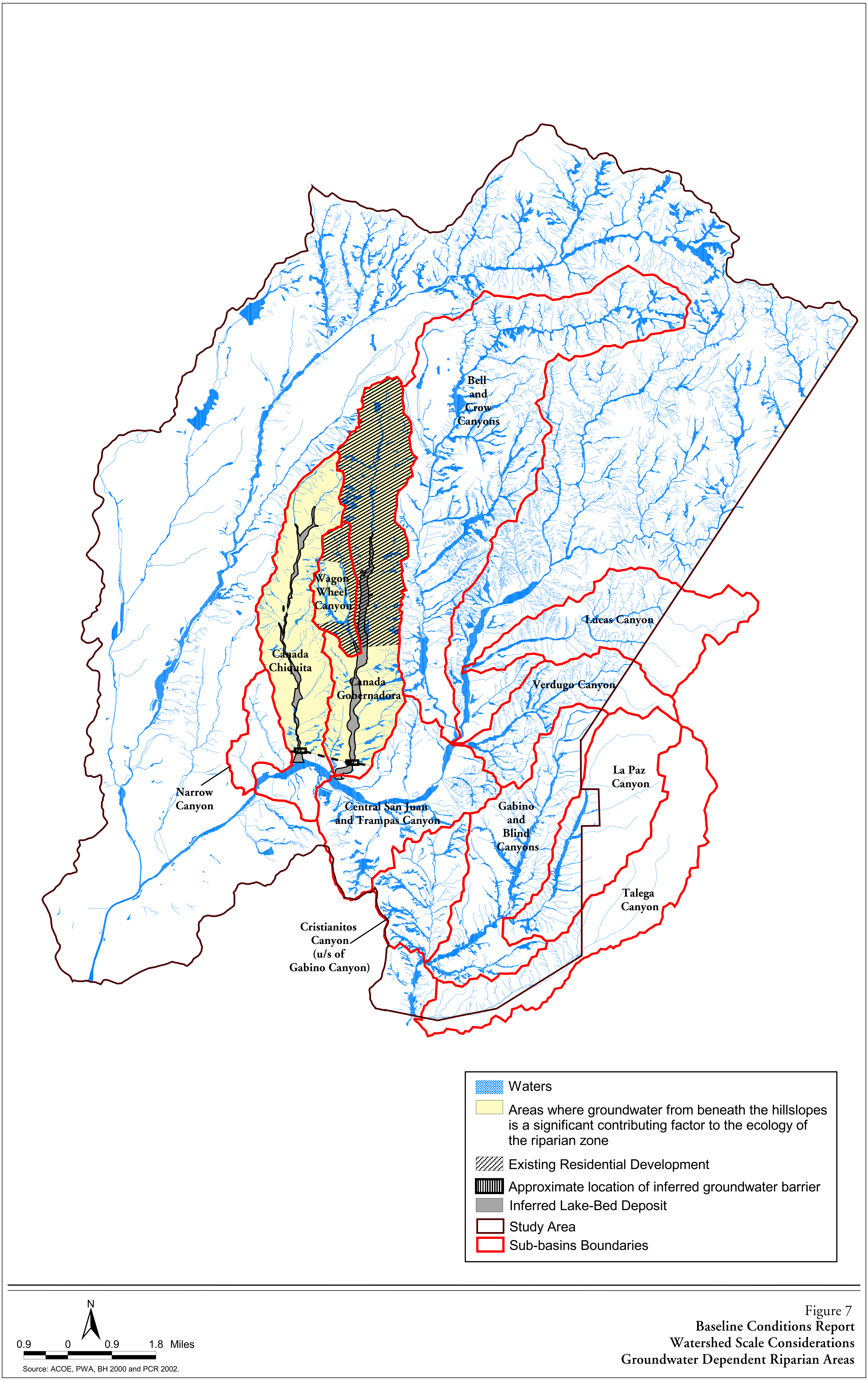
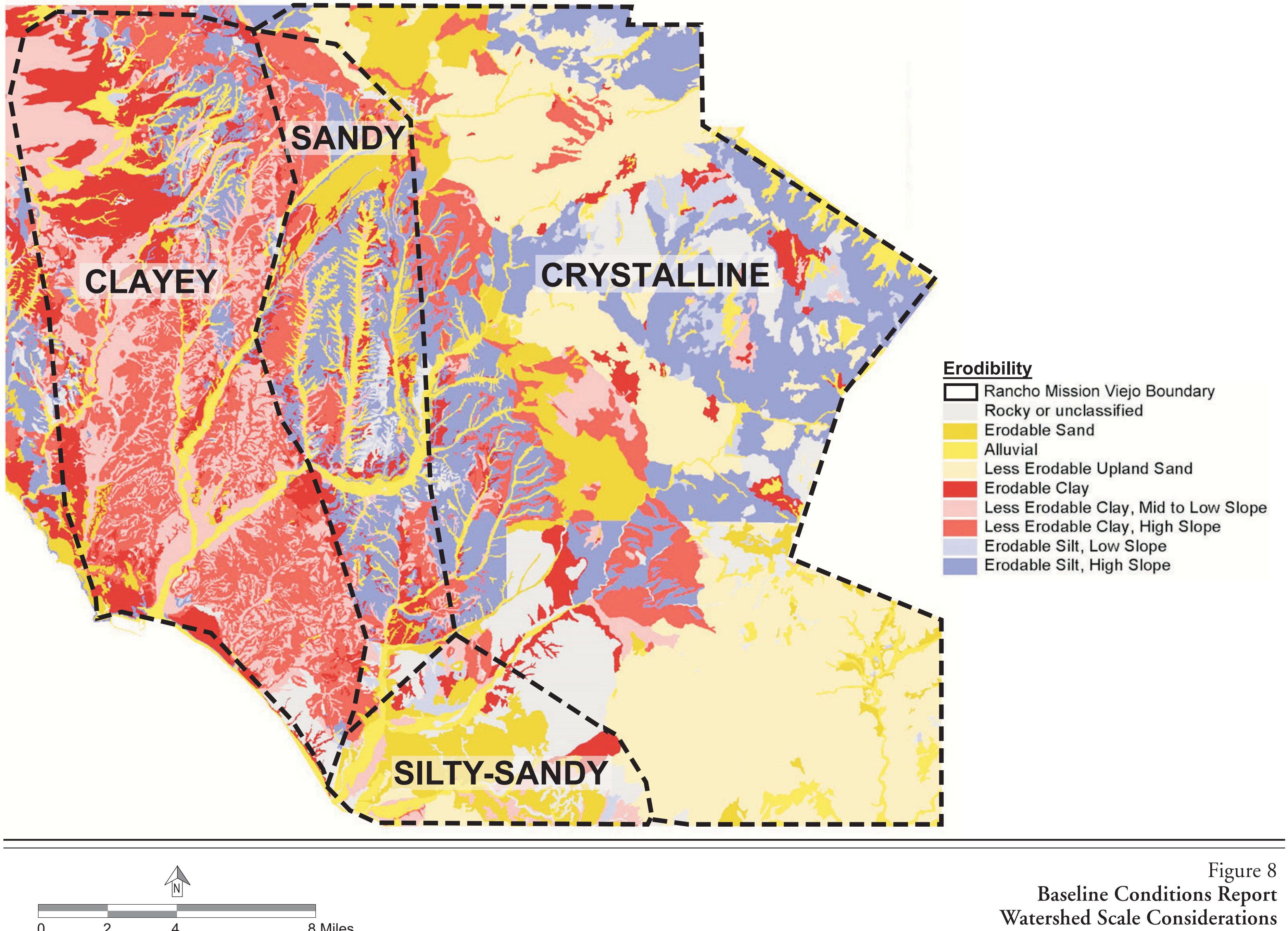
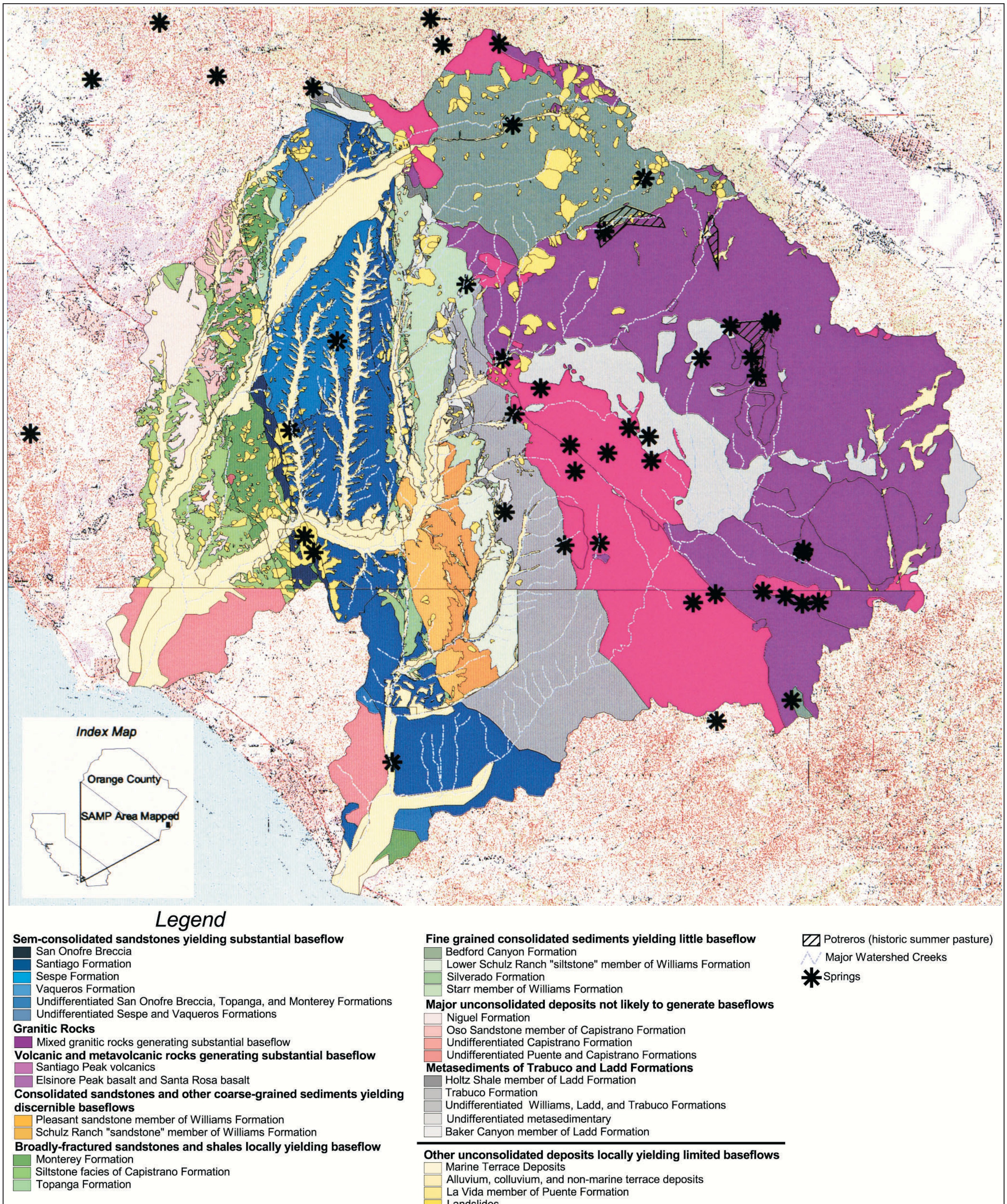


Figure 7
Baseline Conditions Report
Watershed Scale Considerations
Groundwater Dependent Riparian Areas



Source: Balance Hydrologics, Inc., 2000

Figure 8
Baseline Conditions Report
Watershed Scale Considerations
Geomorphic Terrains



N

0 2 4 Miles

Source: Balance Hydrologics, Inc., 2002

Figure 9
Baseline Conditions Report
Watershed Scale Considerations
Bedrock Derived Baseflow

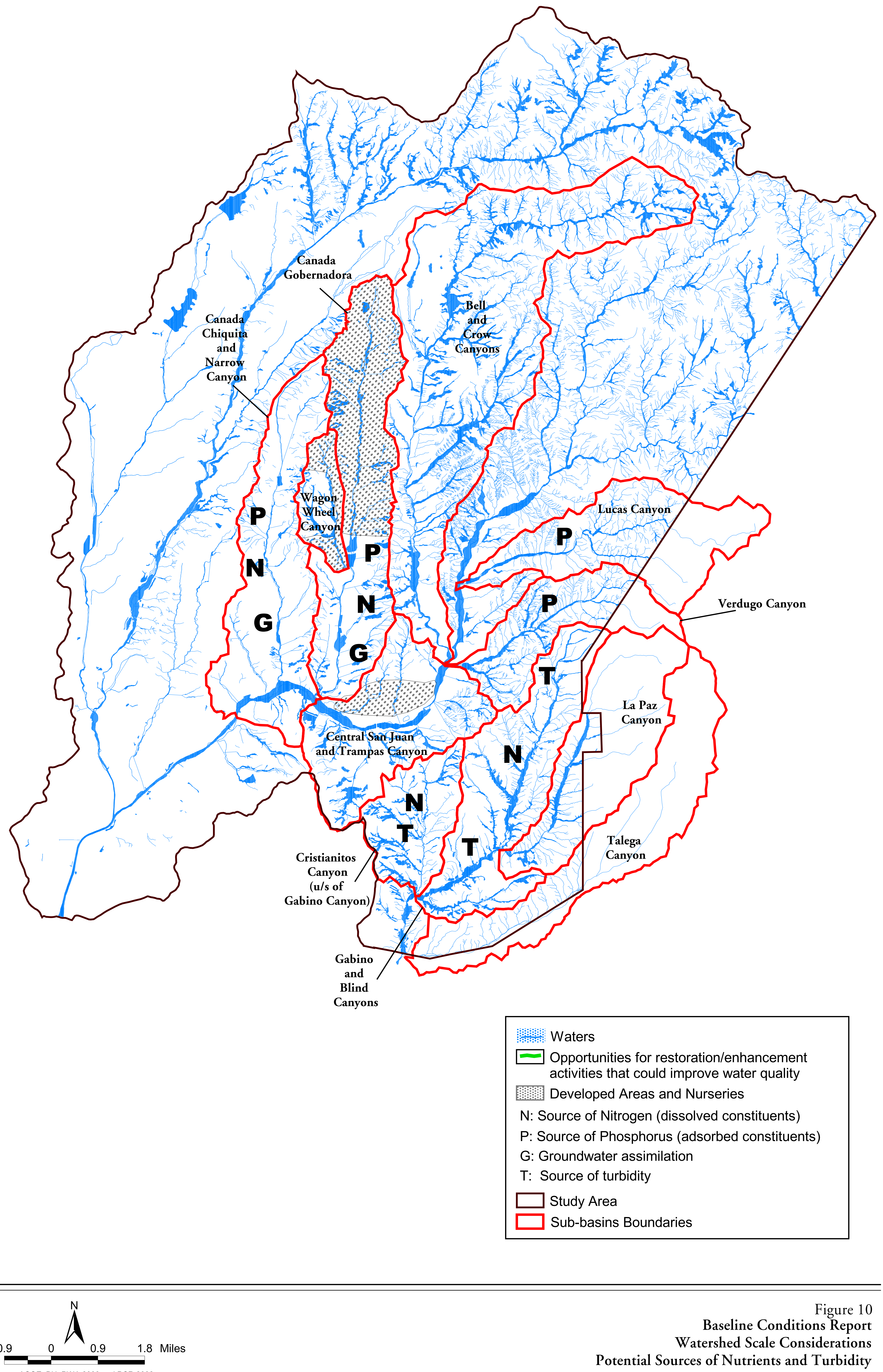


Figure 10
Baseline Conditions Report
Watershed Scale Considerations
Potential Sources of Nutrients and Turbidity

1D. RELATIONSHIP OF PLANNING PRINCIPLES TO SAMP TENETS

Section 1A of this document sets forth the tenets established by the ACOE and CDFG for the SAMP/MSAA program. These tenets and the amplification thereof are overall program goals that support the stated purpose of the SAMP to develop and implement a watershed-wide aquatic resource management plan and implementation program. The Planning Principles set forth in Section 1B are derived from the Baseline Report and focus on the geomorphological and hydrologic processes that shape and alter the creek systems in the planning area over time. Application of both the SAMP tenets and planning principles to the San Juan and San Mateo watershed landscapes will facilitate the identification and subsequent evaluation of a range of aquatic resources reserve program alternatives which recognize the unique attributes of the planning area, achieve the overall program goals, and purpose of the SAMP. The relationship of specific tenets and principles (in abbreviated form) to each other is noted below.

i) No Net Loss of Acreage and Functions of Waters of the U.S./State

- Principle 2: emulate existing runoff/infiltrations patterns
- Principle 3: address potential effects of future land uses on hydrology
- Principle 5: maintain geomorphic structure of major tribs/floodplains
- Principle 8: protect existing groundwater recharge areas

ii) Maintain/Restore Riparian Ecosystem Integrity

- Principle 1: account for hydrologic response of different terrains
- Principle 2: emulate existing runoff/infiltrations patterns
- Principle 3: address potential effects of future land uses on hydrology
- Principle 4: minimize alteration of timing of peak flows
- Principle 7: use infiltration of sandy terrains for groundwater recharge
- Principle 8: protect existing groundwater recharge areas
- Principle 9: protect water quality

iii) Protect Headwaters

- Principle 1: account for hydrologic response of different terrains
- Principle 2: emulate existing runoff/infiltrations patterns
- Principle 3: address potential effects of future land uses on hydrology

iv) Maintain/Protect/Restore Riparian Corridors

- Principle 4: minimize alteration of timing of peak flows
- Principle 5: maintain geomorphic structure of major tribs/floodplains
- Principle 7: use infiltration of sandy terrains for groundwater recharge
- Principle 8: protect existing groundwater recharge areas

v) Maintain or Restore Floodplain Connection

- Principle 1: account for hydrologic response of different terrains
- Principle 2: emulate existing runoff/infiltrations patterns
- Principle 5: maintain geomorphic structure of major tribs/floodplains

vi) Maintain and/or Restore Sediment Sources and Transport Equilibrium

- Principle 5: maintain geomorphic structure of major tribs/floodplains
- Principle 6: maintain coarse sediment yields, storage and transport processes

vii) Maintain Adequate Buffer for the Protection of Riparian Corridors

- Principle 1: account for hydrologic response of different terrains
- Principle 5: maintain geomorphic structure of major tribs/floodplains
- Principle 8: protect existing groundwater recharge areas

viii) Protect Riparian Areas and Associated Habitats of Listed and Sensitive Species

- Principle 2: emulate existing runoff/infiltrations patterns
- Principle 4: minimize alteration of timing of peak flows
- Principle 5: maintain geomorphic structure of major tribs/floodplains
- Principle 6: maintain coarse sediment yields, storage and transport processes
- Principle 7: use infiltration of sandy terrains for groundwater recharge
- Principle 8: protect existing groundwater recharge areas
- Principle 9: protect water quality using a variety of strategies

SECTION 2: SUB-BASIN SCALE PLANNING CONSIDERATIONS

The Planning Considerations identified in this section are intended to be used at the sub-basin or sub-watershed scale. The Planning Considerations are divided into two sub-groups: (1) those that apply to sub-basins within the San Juan Creek Watershed; and (2) those that apply to sub-basins in the San Mateo Creek Watershed. Each sub-basin description includes:

- A summary of WES observations (as interpreted by RMV consultants and not necessarily reflective of ACOE official guidance or policy).
- A depiction of the hydrology, water quality and habitat integrity for each sub-basin as mapped by the ACOE. The ACOE maps displaying the average of relevant indicator scores for each reach within the study area ranging from 1 (lowest integrity) to 5 (highest integrity) for hydrologic, water quality, and habitat integrity indices are provided in Appendix A. The average for the indicators that contribute to hydrologic, water quality, and habitat integrity scores for each sub-basin are displayed accordingly: Chiquita (Figures 12, 13, and 14), Gobernadora (21, 22, and 23), Wagon Wheel (30, 31, and 32), Verdugo (Figures 42, 43, and 44), Gabino (Figures 58, 59, and 60), and La Paz (Figures 65, 66, and 67).
- A summary of the Planning Considerations – Significant Terrains and Hydrology Features of the sub-basin.
- A summary of Planning Recommendations for the sub-basin.
- A set of maps and aerial photos highlighting both Planning Considerations for Significant Terrains and Hydrology Features and Planning Recommendations from the Baseline Report and supplementary field studies and observations.

No direct source citations are provided for the text and data derived from the Baseline Report as each sub-basin corresponds to the analogous section in the baseline report (i.e., *Sections 6.1.1* through *6.1.4* for sub-basins in the San Juan Creek Watershed and Sections *6.2.1* through *6.2.4* for those within the San Mateo Watershed).

4

2A. SAN JUAN CREEK WATERSHED

i) Chiquita Sub-basin

WES General Assessment and Conclusions

- Overall Hydrologic function is high.
- Overall Water Quality and Habitat Integrity is moderate.
- Hydrologic regime is intact. No significant diversions, retention facilities, etc.
- High indicator scores of extent of riparian vegetation and floodplain interaction.
- Riparian corridor breaks at the drainage basin scale, especially in the area at and immediately below Oso Parkway.
- Moderately altered sediment regime, as indicated by entrenched stream reaches.
- Agricultural land use results in risk of nutrient, pesticide, and sediment loading to the stream.
- Lack of native plant buffer and agricultural land use in the sub-basin poses risks to water quality and habitat integrity.
- Habitat integrity could be increased by establishment of native plant buffers.

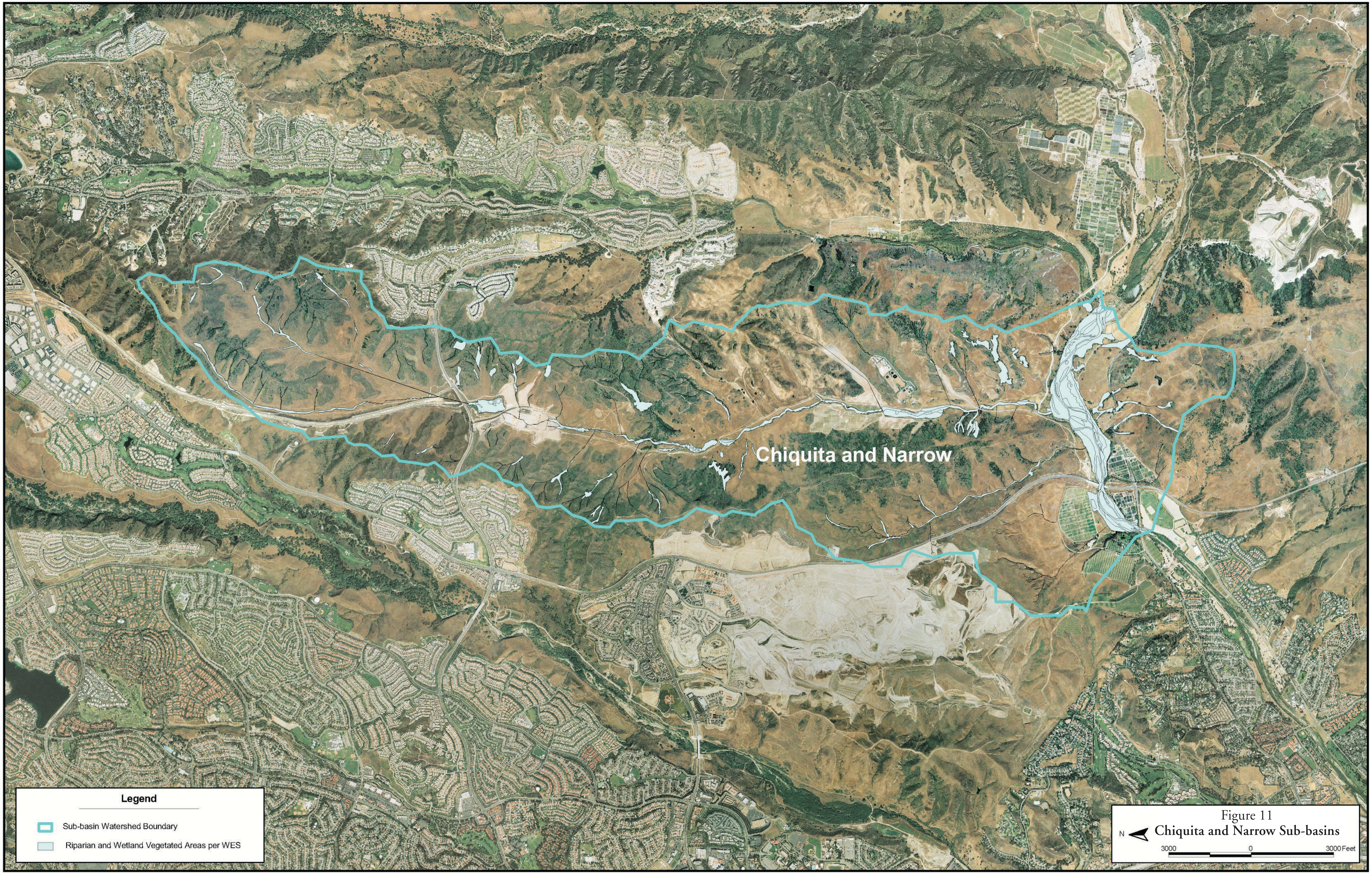


Figure 11
Chiquita and Narrow Sub-basins

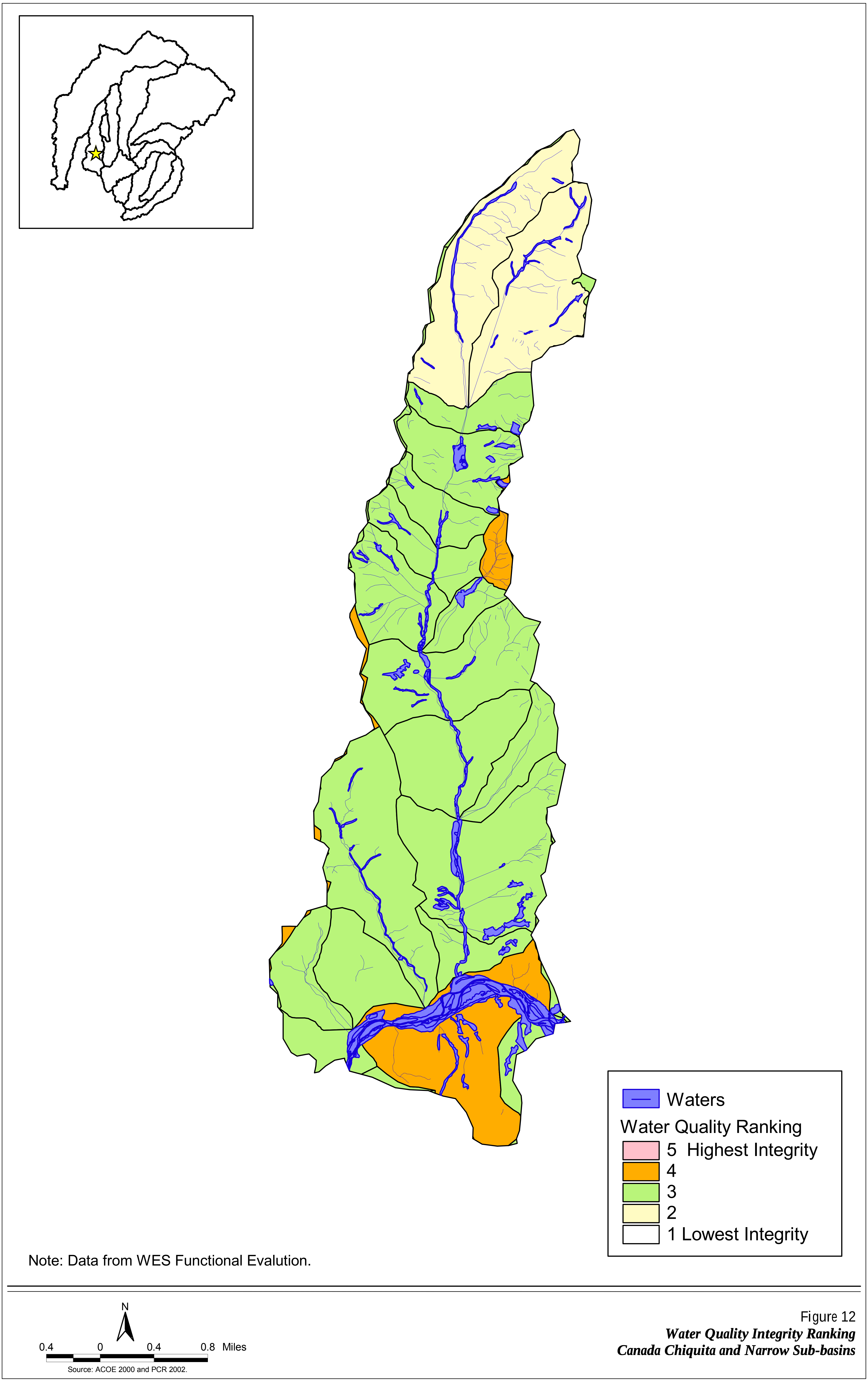


Figure 12
Water Quality Integrity Ranking
Canada Chiquita and Narrow Sub-basins

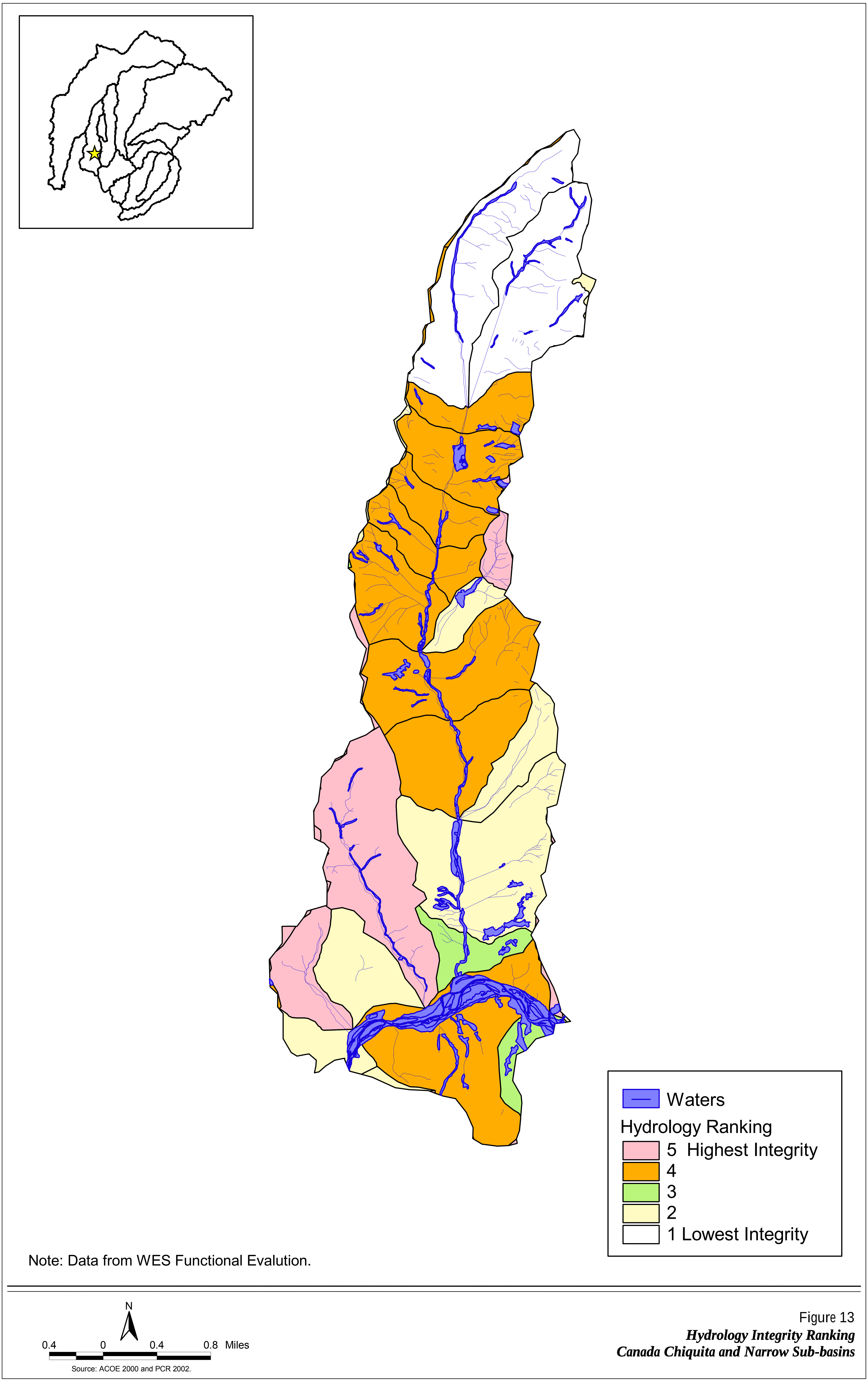


Figure 13

Hydrology Integrity Ranking
Canada Chiquita and Narrow Sub-basins

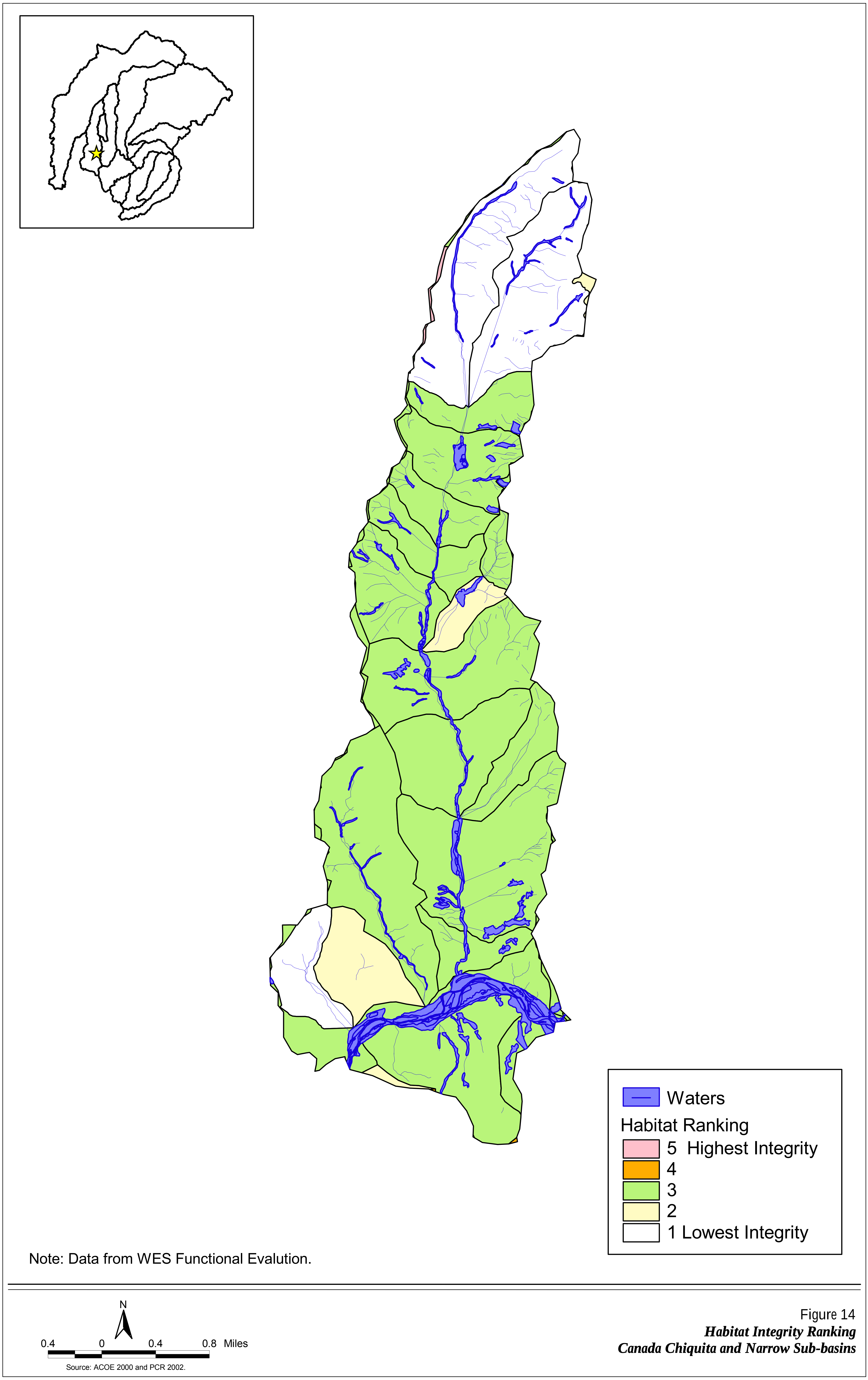


Figure 14
Habitat Integrity Ranking
Canada Chiquita and Narrow Sub-basins

Planning Considerations - Significant Terrains and Hydrologic Features

- Main canyon and side canyon terrains are primarily sandy or silty sand and the sub-basin generally has high infiltration capacity.

- Side canyons (particularly east of the creek) contain deep sandy deposits and serve important hydrologic functions through infiltrating low volume storms to groundwater and high volume storms to the main stream channel.

- Ridges on the east side of the valley are characterized by, rock outcroppings, and areas of hardpan which are eroded remnants of claypans formed in the geologic past that have eroded to form mesas, and locally steep slopes. These areas have minimal infiltration and channel flows into the major side canyons.

- The sandy substrates beneath the tributary swales make them prone to incision under existing and altered hydrologic regimes.

- Based on comparisons with 1938 aerial photographs, the main creek channel has been relatively stable over the last 60 years. The deepening of the creek channel in portions of the mainstem of Chiquita Creek may be a result of long-term, gradual geologic processes, terrains, land use, or a combination of factors. The current channel bed elevation may be somewhat stabilized by pre-historic cohesive lake-bed or quiet-water sediments.

- Groundwater derived from beneath the hill slopes and ridges is a major source of water contributing to the perennial nature of the creek system. Inferences have been drawn indicating that water levels in the alluvium below Chiquita Creek are at least in large part isolated from those in the sands and gravels beneath San Juan Creek, by a sub-surface barrier to groundwater movement into San Juan Creek.

- The sub-basin provides some of the lowest predicted sediment yields and transport rates of the sub-basins analyzed in the San Juan watershed, except during extraordinary episodic events, when large volumes of coarse sediment may be mobilized and transported to San Juan Creek.

- Relative to Gobernadora Creek and lower Gabino Creek, the area of floodplain connection is fairly limited. The hydrologic connections, both surface and subsurface, to the main side canyons appear to be more important in hydrologic terms than the floodplain connection.

- The combination of perennial flow in the Chiquita Creek and subsurface water movement in Chiquita Canyon support riparian habitats, freshwater and alkaline marsh and slope wetlands.

- Many of the slope wetlands on the east side of the valley appear to be sustained by large volumes of stored groundwater within the Santiago (and to a lesser extent the Sespe) formations that move along low permeability silt beds and discharge at breaks in the slope. The slope wetlands on the west side of the valley are sustained by fairly localized recharge of San Onofre breccia and derivative landslide deposits.

Planning Recommendations

- Consistent with the SAMP Tenets, protect the headwaters of Upper Chiquita Canyon.

- Avoid creating impervious surfaces in the sandy soils of the canyon floor. To the extent feasible, land uses in the major side canyons should be limited to primarily pervious surfaces in order to maintain infiltration.

- Emulate existing terrains/hydrology and sediment transport processes by locating development on the ridges, which under present conditions have higher runoff rates and direct surface runoff flows to the permeable substrate of the major side canyons and along the valley floor.

- Promote stormwater surface flow connectivity between the major side canyons and the main stream channel to maintain transient surface channel connections that occur following extreme rainfall events, without significantly changing connections during small storms.

- Identify natural treatment systems for water quality treatment and stormwater detention that would be appropriate in the sandy soils of the major side canyons and the valley floor.

- Maintain groundwater recharge to the shallow subsurface water system to sustain flows to Chiquita Creek.

- Address existing areas of channel incision that result from primarily localized processes/land use practices, as contrasted with terrace-forming valley-deepening areas that are primarily a result of long-term geologic conditions. Site by site geomorphic analysis will be undertaken to define these areas.

- To the maximum extent practical, avoid direct impacts to the slope wetlands and maintain primary recharge characteristics that support these wetlands.

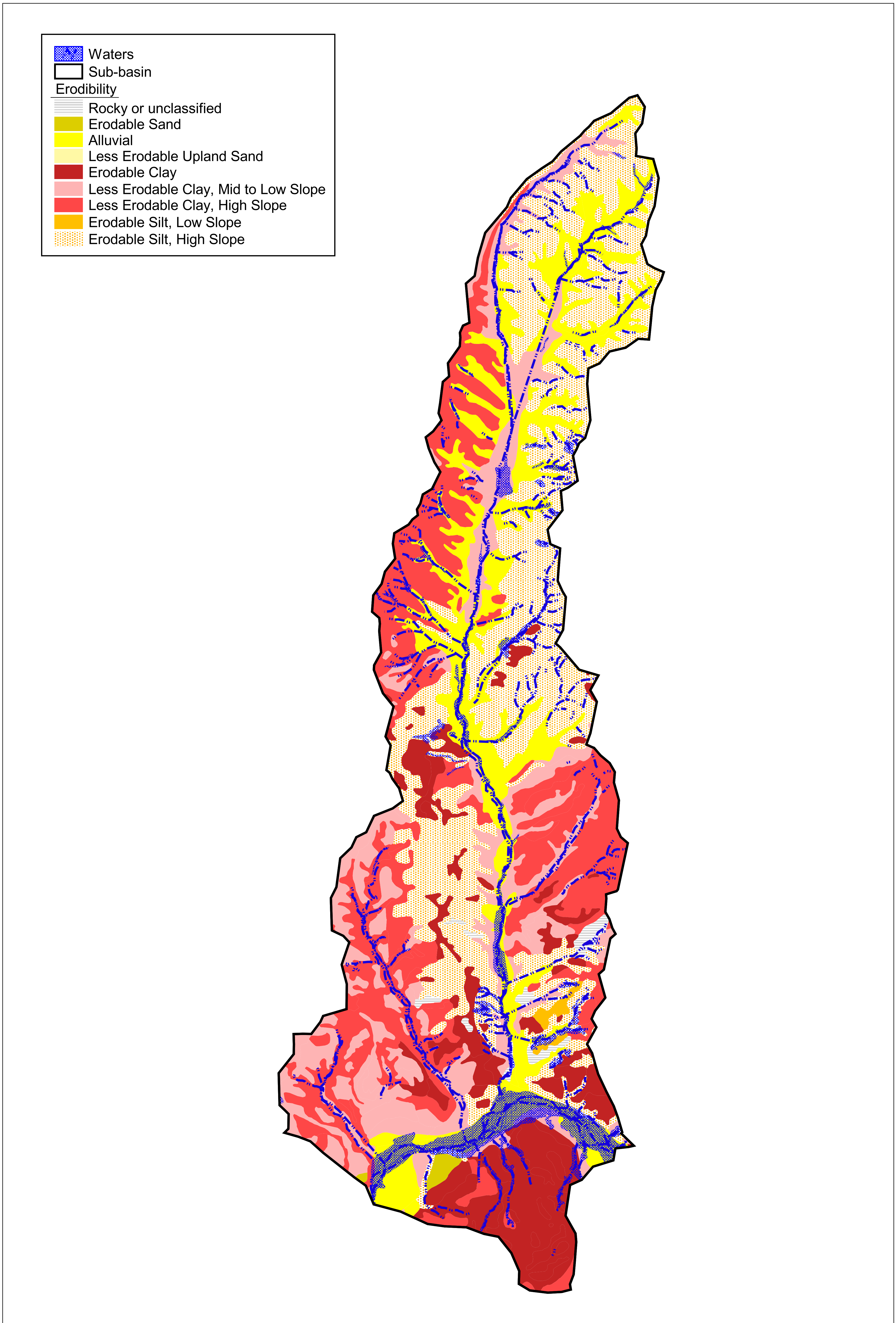


Figure 15
Sub-Basin Geomorphic / Hydrologic Features
Landscape Scale Terrains for the
Chiquita and Narrow Canyon Sub-basins

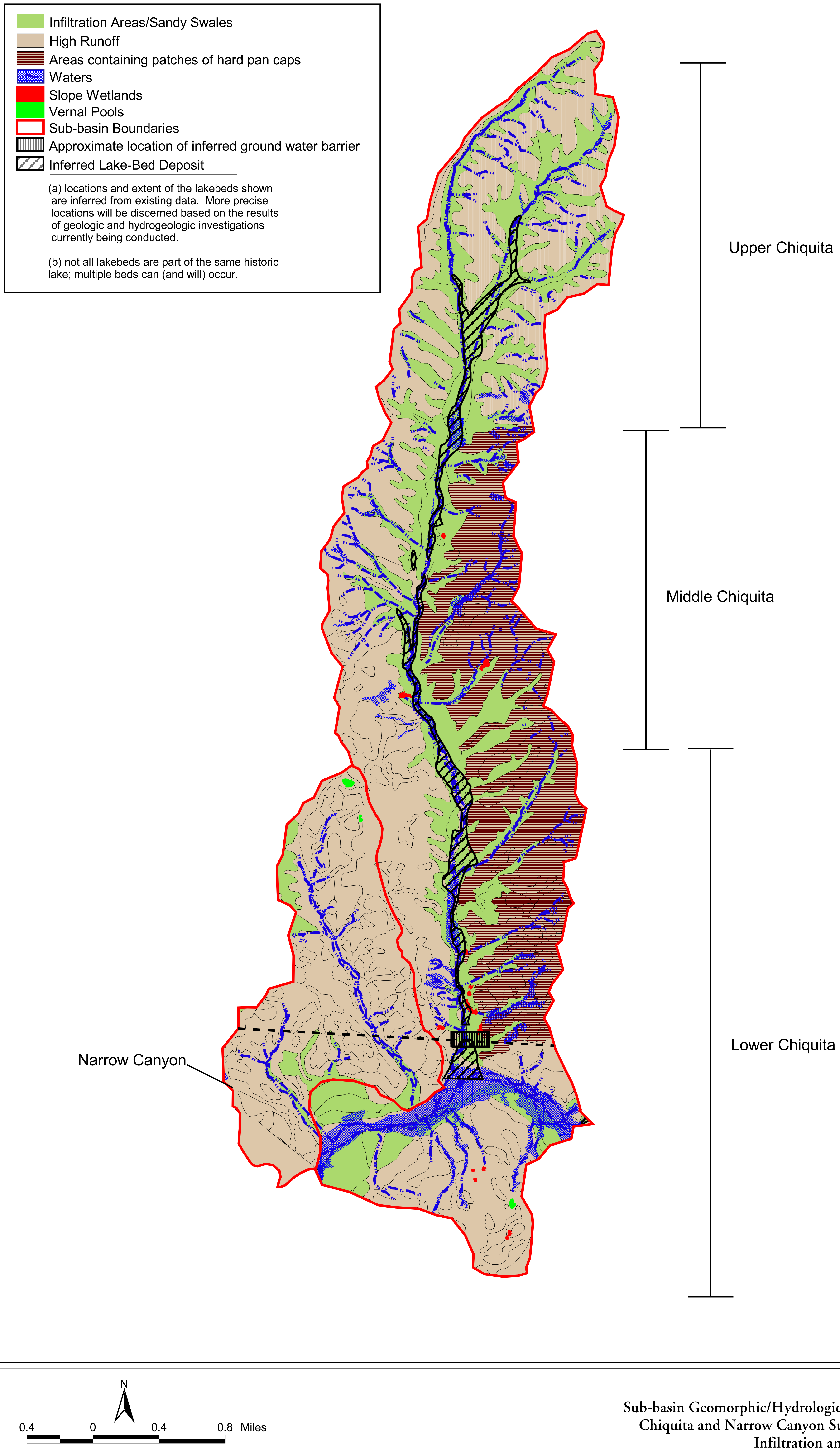
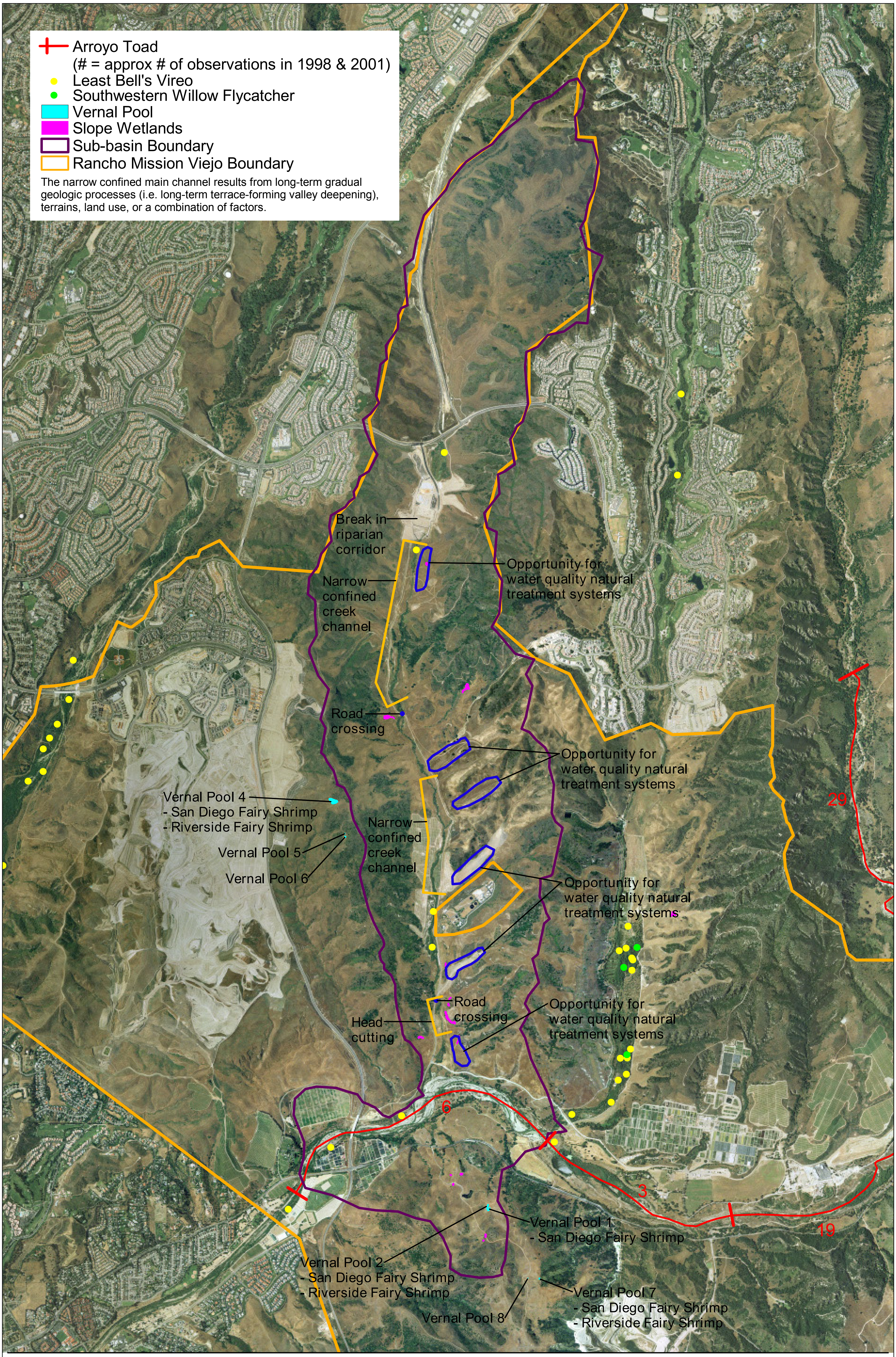


Figure 16
Sub-basin Geomorphic/Hydrologic Features
Chiquita and Narrow Canyon Sub-Basins
Infiltration and Runoff



N

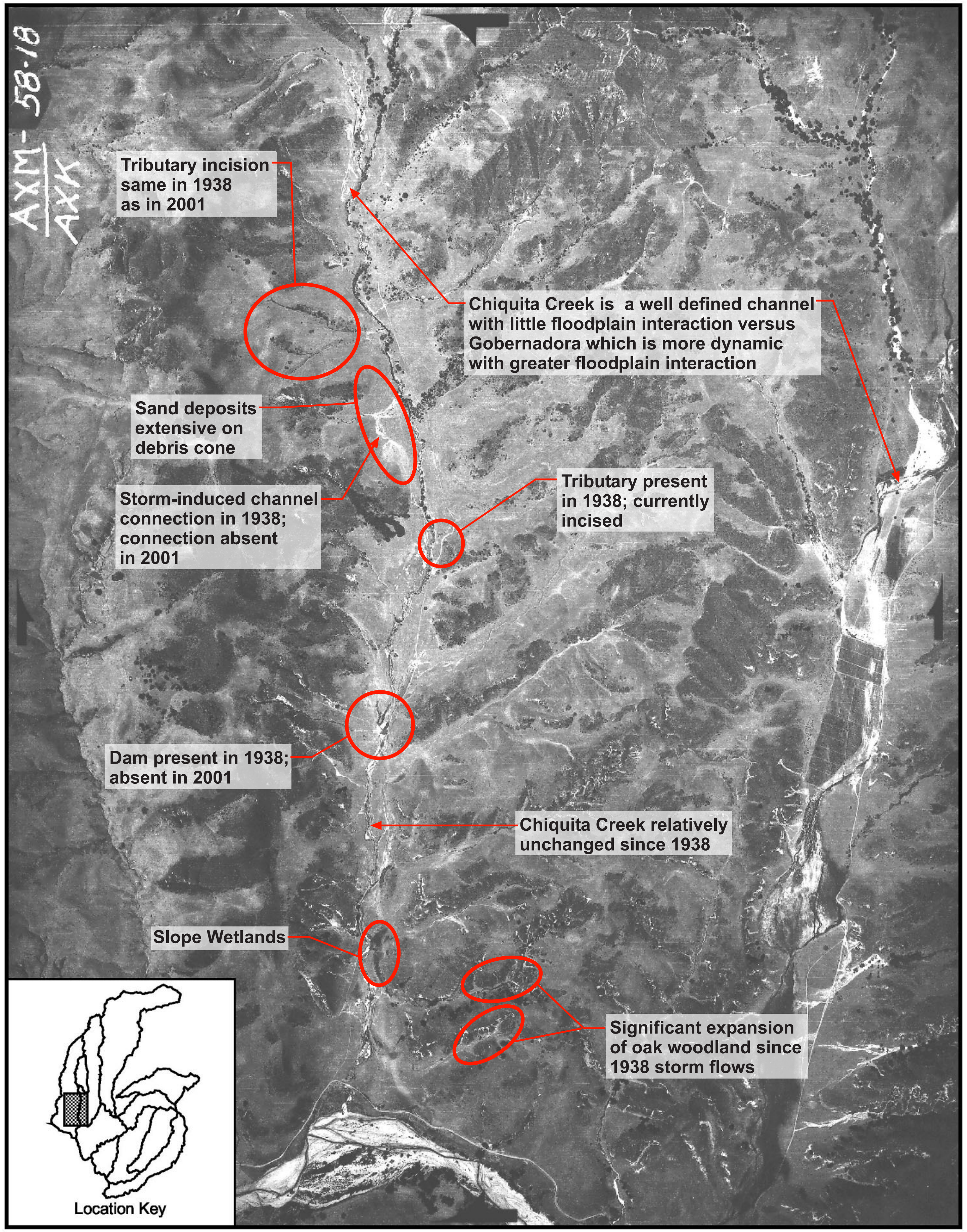
3000 0 3000 Feet

Source: Eagle Aerial Imaging 2001 and PCR 2002.

Figure 17

Sub-basin Geomorphic/Hydrologic Features Canada Chiquita Opportunities for Restoration/Stabilization and Water Quality Natural Treatment Systems

1938



2001

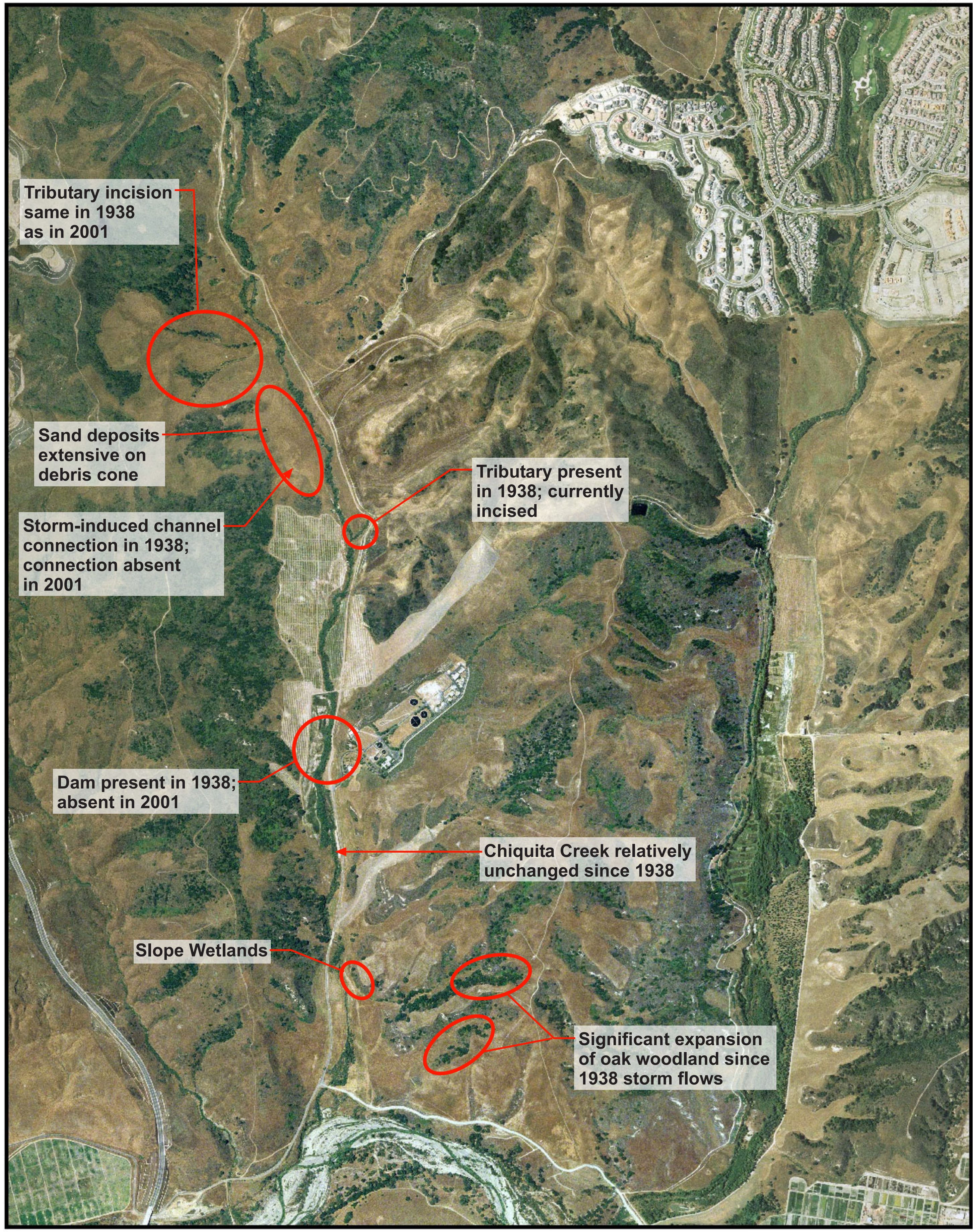
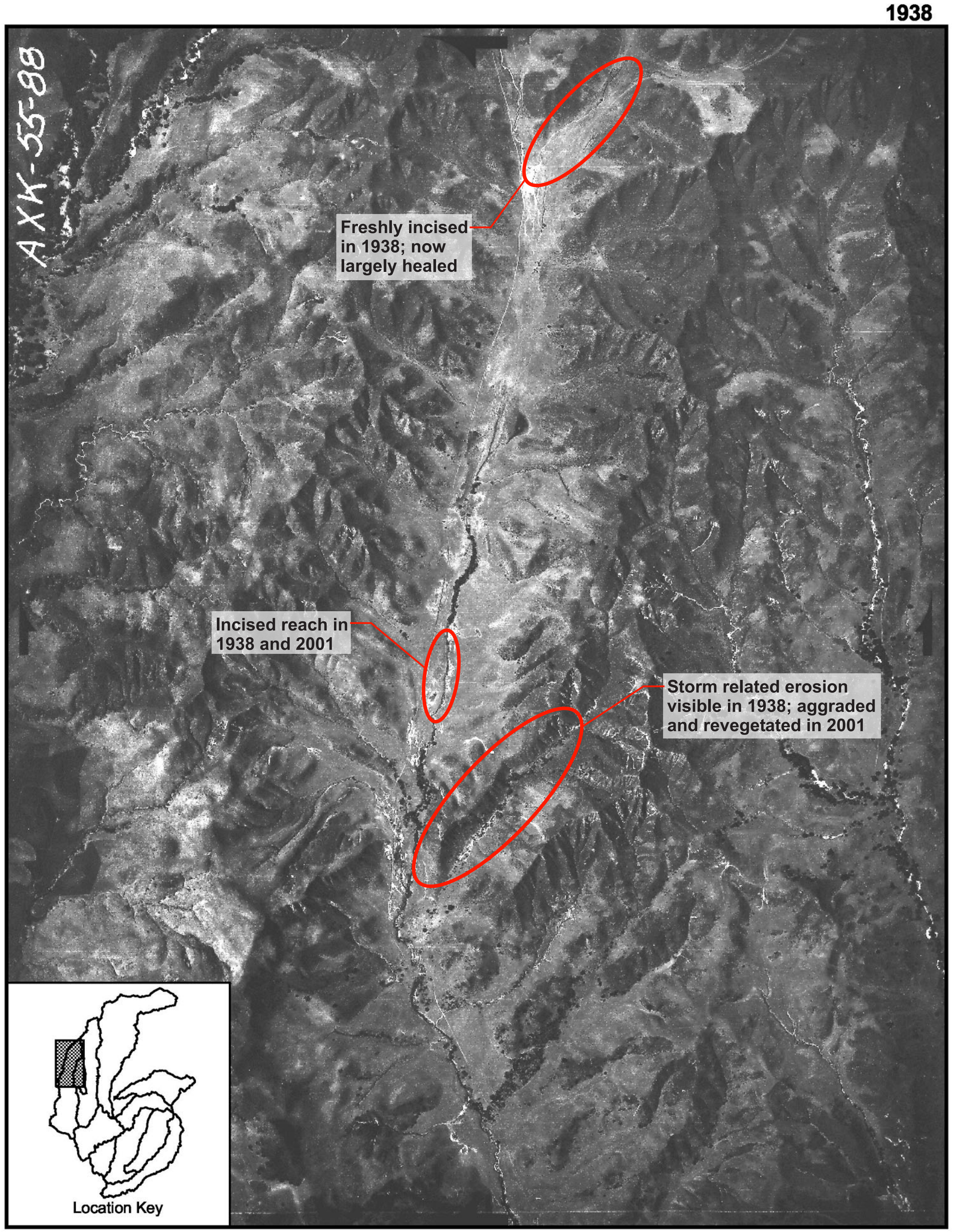


Figure 18
Lower Chiquita
1938 and 2001 Aerial Photographs



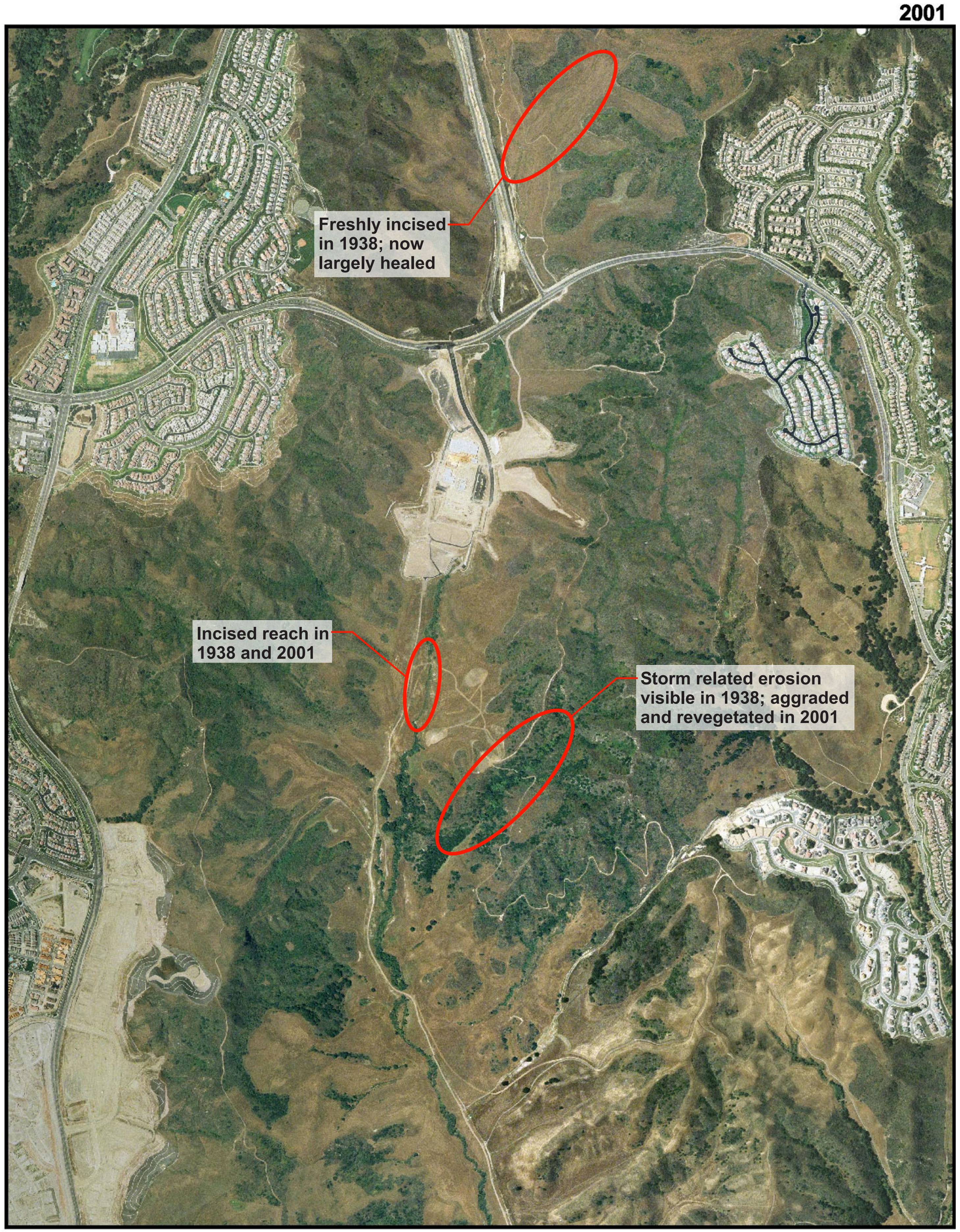


Figure 19
Upper Chiquita
1938 and 2001 Aerial Photographs

5

ii) Cañada Gobernadora Sub-basin and Central San Juan North of San Juan Creek

WES General Assessment and Conclusions

- Significant differences in riparian integrity below the RMV boundary vs. upstream of the RMV boundary (i.e., within Coto de Caza).
- Overall Hydrology and Water Quality integrity for the entire sub-basin is moderate. Overall Hydrology and Water Quality integrity for the portion of the sub-basin downstream of the RMV boundary is significantly higher than the portion upstream of the RMV boundary.
- Overall, Habitat Integrity for the entire sub-basin is low; however, Habitat Integrity for the portion of the sub-basin downstream of the RMV boundary is moderate.
- Downstream of the RMV boundary, the channel-floodplain interaction is generally intact and the flood-prone area supports riparian vegetation.
- The integrity of the mainstream is adversely affected by perennialized stream flow.
- Habitat integrity could be increased by establishment of native plant buffers adjacent to the stream.
- Water Quality integrity is adversely affected by altered sediment regime.
- Agricultural land uses result in risk of nutrient, pesticide and sediment loading to the stream.

Figure 20
Gobernadora Sub-basin

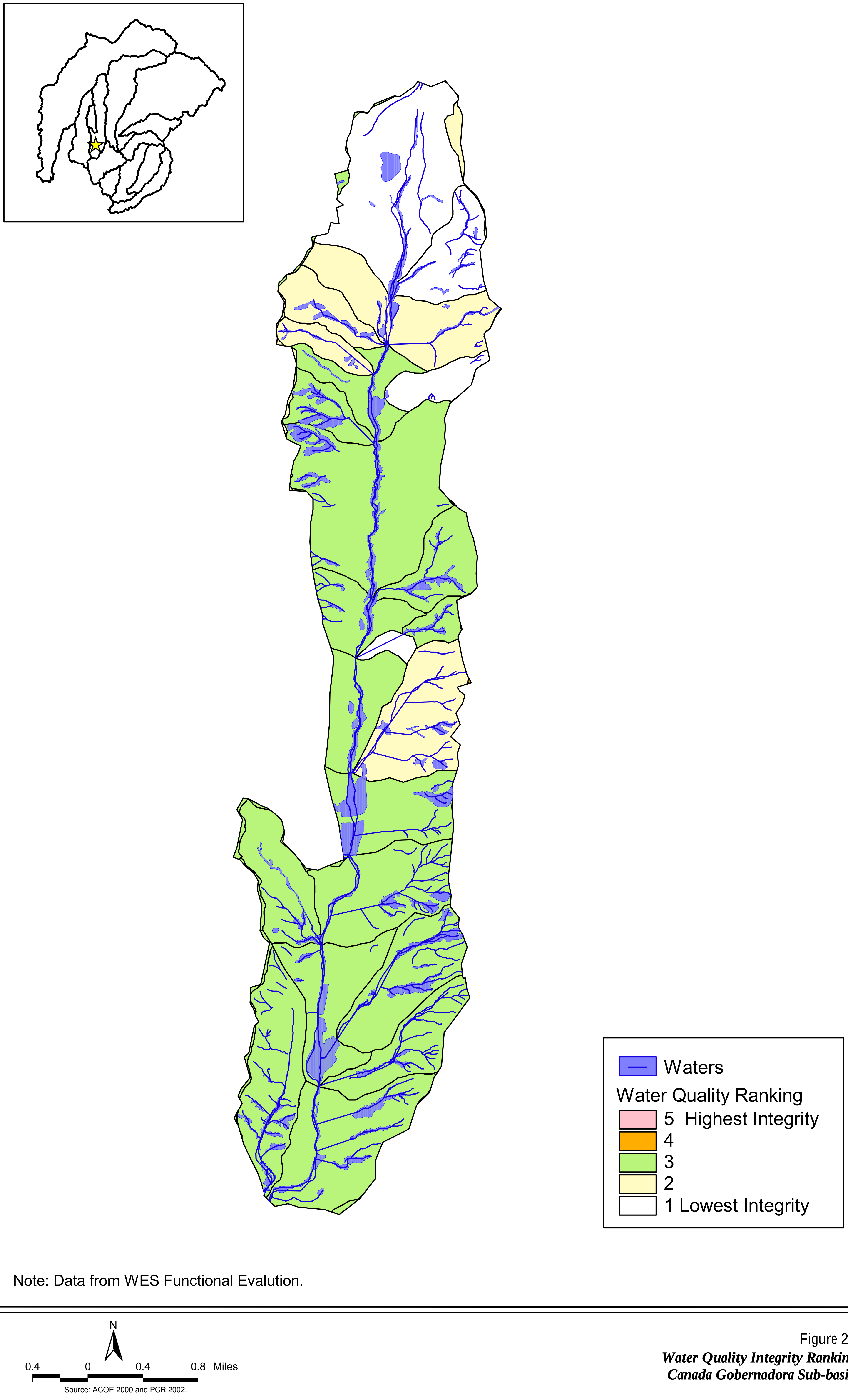
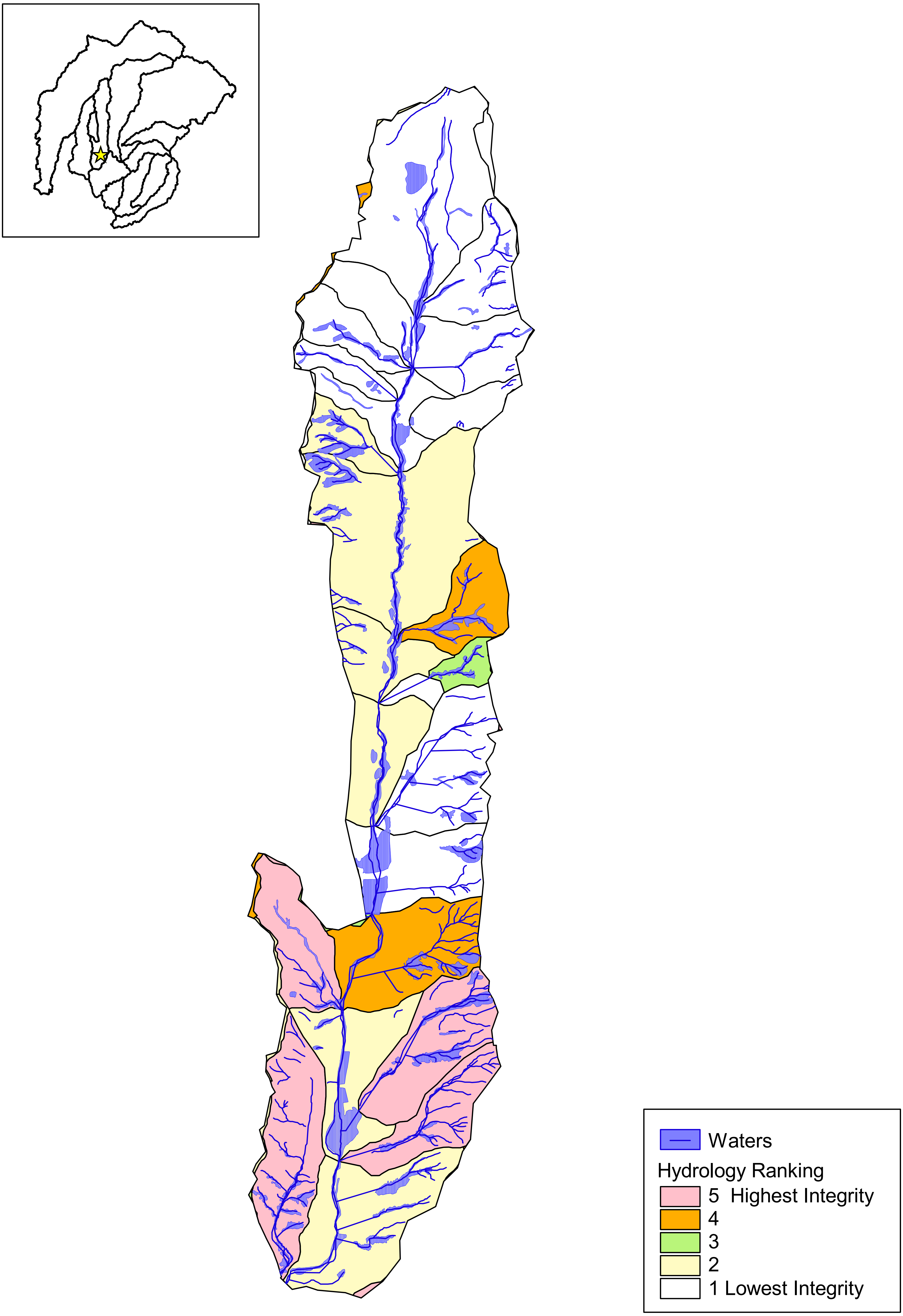


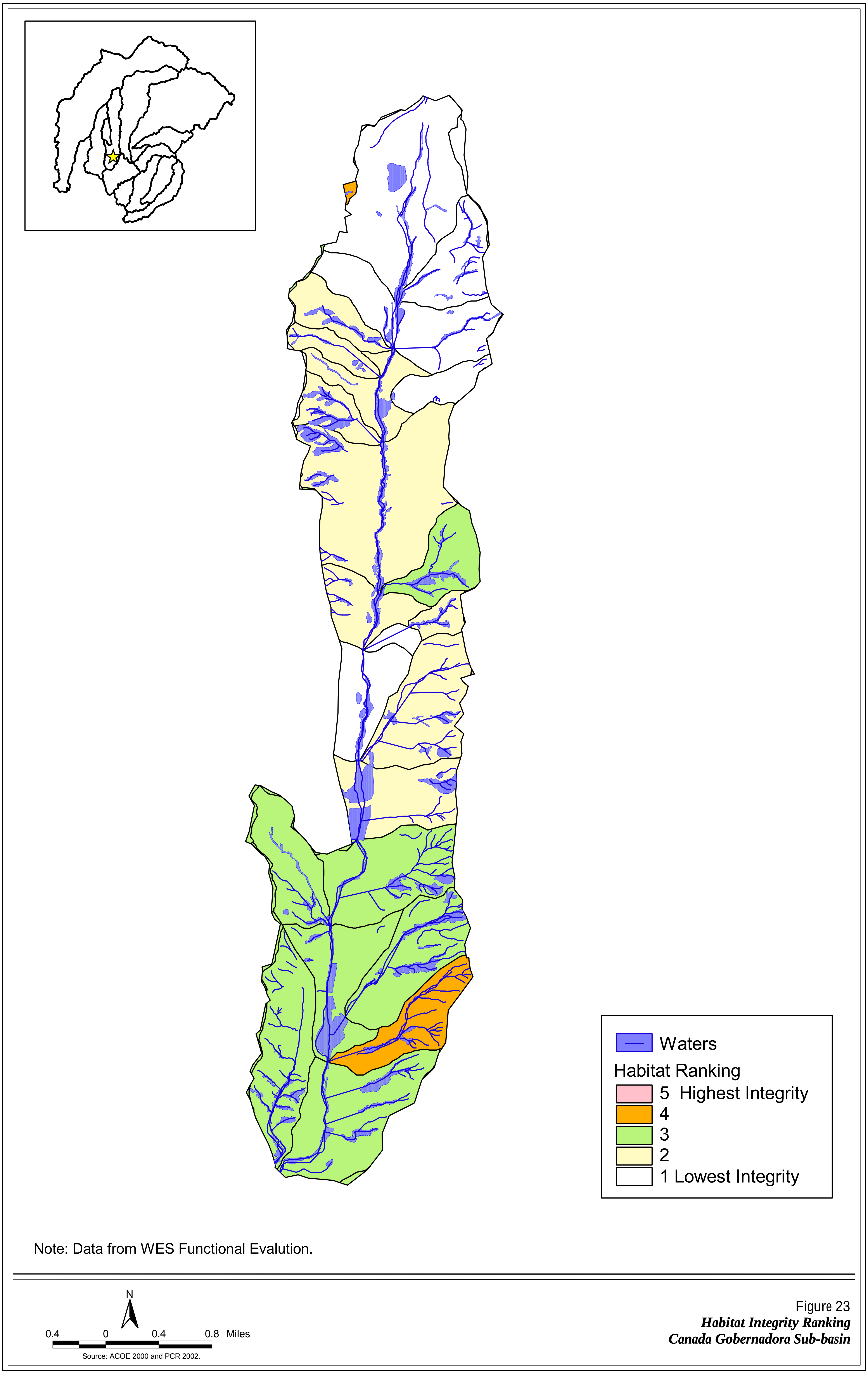
Figure 21
Water Quality Integrity Ranking
Canada Gobernadora Sub-basin



Note: Data from WES Functional Evalution.

Source: ACOE 2000 and PCR 2002.

Figure 22
Hydrology Integrity Ranking
Canada Gobernadora Sub-basin



Note: Data from WES Functional Evalution.

Figure 23
Habitat Integrity Ranking
Canada Gobernadora Sub-basin

Planning Considerations - Significant Terrains and Hydrology Features

- Cañada Gobernadora contains some of the highest potential infiltration areas in the study area, particularly in the valley floor, which is characterized by deep alluvial deposits with interbedded clay lenses. However, high groundwater levels may affect the overall infiltration capacity of the sub-basin.

- Total runoff in Cañada Gobernadora is proportionately higher than other sub-basins, due to the size, elongated shape, and amount of existing development in the upper portion of the watershed.

- The hill slopes and ridges in the sub-basin exhibit areas of exhumed hardpan overlying sandy and silty substrates (the eroded remnants of claypans formed in the geologic past) or contain exposed rock outcrops or other areas of steep slopes. These areas presently exhibit rapid runoff comparable to Class D soils, although having less soil moisture storage they likely generate runoff with most storms.

- Due to the elongated configuration and the predominance of sandy terrains in the Gobernadora Sub-basin, first order streams are proportionally less of the total stream length than in several other sub-basins. Many of the tributaries consist of channel-less swales. These swales likely convey a combination of surface and subsurface flow to the main-stem creek and may exhibit surface connection following extreme runoff events.

- Historic photos indicate that the mainstem creek meandered freely across the valley floor over most of the length of the valley downstream from the mouth of Wagon Wheel Canyon.

- Groundwater derived from beneath the hill slopes and ridges is a major source of water contributing to the perennial nature of the creek system. Inferences have been drawn indicating that water levels in the alluvium below Cañada Gobernadora are at least in large part isolated from those in the sands and gravels beneath San Juan Creek, due to a sub-surface barrier to groundwater movement into San Juan Creek. The perennial nature of the creek in its upper reaches is likely influenced primarily by urban runoff from upstream development, while perennial flow in the lower portion of the creek is influenced by a combination of urban runoff, increased recharge from upstream areas, and lateral subsurface inflow to the valley floor.

- High sediment yields are currently generated from the already developed, disturbed upper portion of the sub-basin and have been deposited in the flats below Coto de Caza, where flows from Wagon Wheel Canyon enter the sub-basin. In 2001, the creek moved out of its previous channel in this location, cut a new channel (i.e., avulsed) and resulted in downstream deposition of sediments.

- Emergent marsh habitat, including alkali wetlands, and willow habitats are present in the Gobernadora Ecological Restoration Area (GERA) wetlands restoration area, with a mix of southern willow riparian and sycamore-willow woodland areas upstream to the boundary of Coto de Caza.

- The Central San Juan Sub-basin north of San Juan Creek has two major tributaries of note, one is a major canyon that bisects the Gobernadora Planning Area, beginning as a moderate- to high-gradient, scrub-oak dominated riparian zone in a chaparral matrix, transitioning to a mature oak woodland as the gradient decreases, until it becomes a moderately incised channel characterized by mule fat scrub. The other tributary consists of high gradient scrub-oak in a chaparral matrix in its upper portion, transitioning to southern-willow riparian habitat as the slope flattens. This second drainage flows into a man-made impoundment with limited wetland fringe vegetation.

- Unlike other sub-basins and Cañada Gobernadora, whose discharges join San Juan Creek at a primary confluence point, stormwater runoff from the Central San Juan catchments is distributed in numerous locations along the adjoining reach of the main San Juan Creek channel.

- The reaches of the central portion of San Juan Creek in the vicinity of the Gobernadora Sub-basin are important as sediment storage and transport reaches, conveying, storing and sorting coarse sediments from upstream terrains. Due to the size of this reach of San Juan Creek, there is a substantial amount of bedload sediment transport to downstream areas that occurs during major episodic events.

- The middle reach of the main stem of San Juan Creek is a broad, meandering stream with a coarse substrate and several floodplain terraces. The Creek supports a mosaic of southern willow riparian woodland, mule fat scrub, open water and sand bars, with the adjacent terraces supporting coast live oak woodland and southern sycamore riparian woodland.

- The high topographic complexity of San Juan Creek, which includes a variety of secondary channels, pits, ponds and bars, supports a small population of the federally listed arroyo toad. Several factors, such as the invasive species and the limited extent and duration of water sources may influence the arroyo toad populations in this area.

Planning Recommendations

- Protect Cañada Gobernadora valley floor above the knickpoint to provide for creek meandering (as occurred historically) and for restoration of riparian processes and habitat.

- In order to emulate current hydrologic patterns, development areas should be set back from the valley floor and focus on areas that presently manifest Class D soils runoff characteristics, including those areas with existing hardpan caps.

- Deep alluvial deposits that function as important infiltration/recharge areas underlie the valley floor and adjacent tributary swales. At the same time, any changes in future stormwater flows to these areas may need to be accompanied by groundwater management due to limited infiltration capacity resulting from high groundwater levels.

- Given the size of the valley floor, there are opportunities for creating natural treatment systems to treat potential existing and future urban runoff from the Gobernadora Sub-basin, as well as provide opportunities for expanded wetlands habitat areas.

- Sediment management and creek restoration activities may be necessary in lower Gobernadora Canyon to address the present excessive sediment input from upstream urbanized areas. The increased sediment resulting from upstream construction will likely be moving through the system for a prolonged period. Eventually, sediment loads may decrease due to buildout of the upper watershed. Consequently, floodplain restoration should account for both the existing and potential future sediment regimes.

- Existing channel incision that has isolated the Creek from the floodplain in some areas should be addressed as part of the restoration effort.

- Protect the GERA and, to the extent feasible, minimize impacts to major riparian areas consistent with the overall restoration and management plan.

- In order to help maintain the sediment transport functions of the central reach of San Juan Creek, the timing of peak flows in Cañada Gobernadora at the confluence with San Juan Creek should be managed to emulate existing conditions and avoid coincident peaks flows with San Juan Creek.

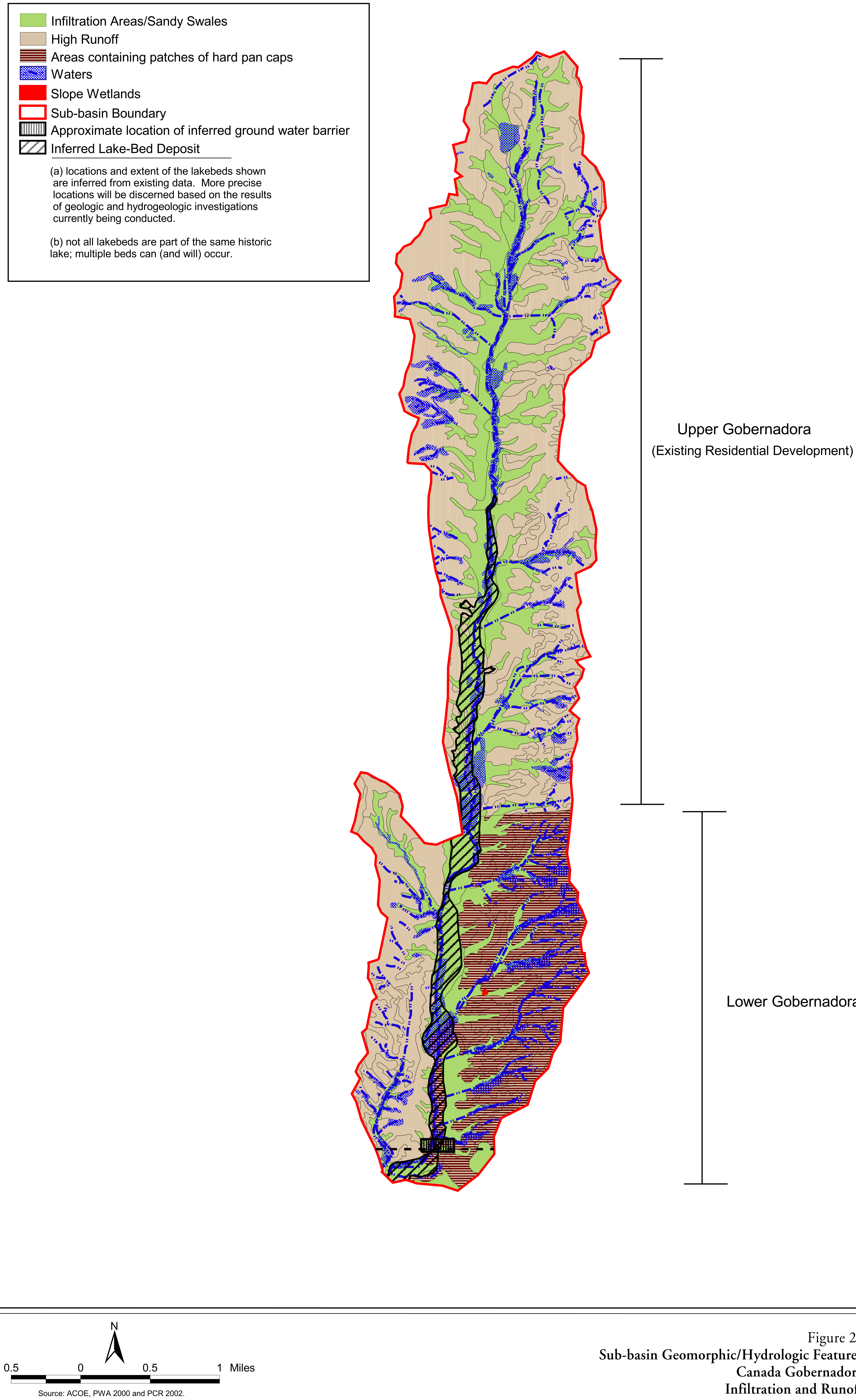


Figure 24
Sub-basin Geomorphic/Hydrologic Features
Canada Gobernadora
Infiltration and Runoff

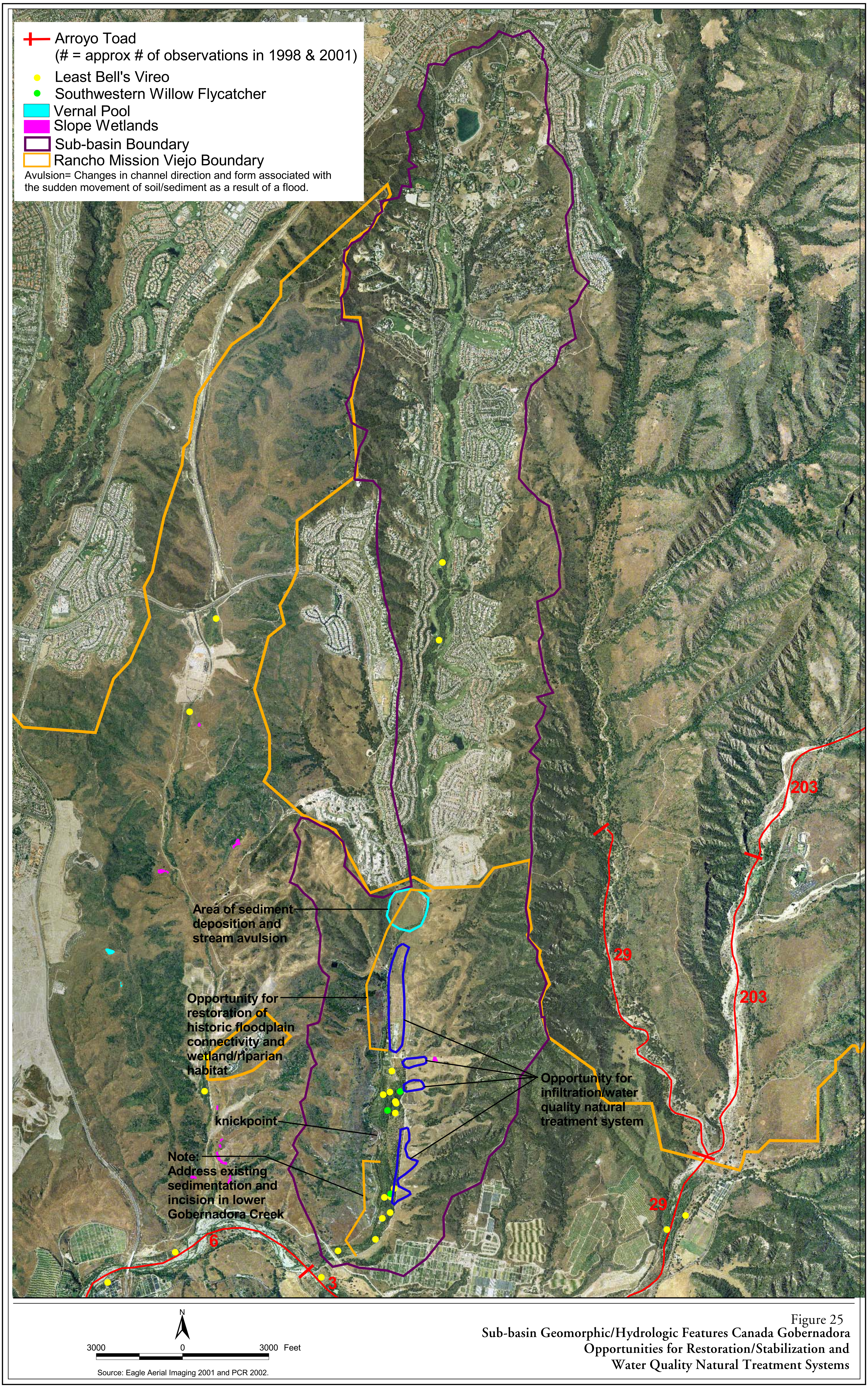
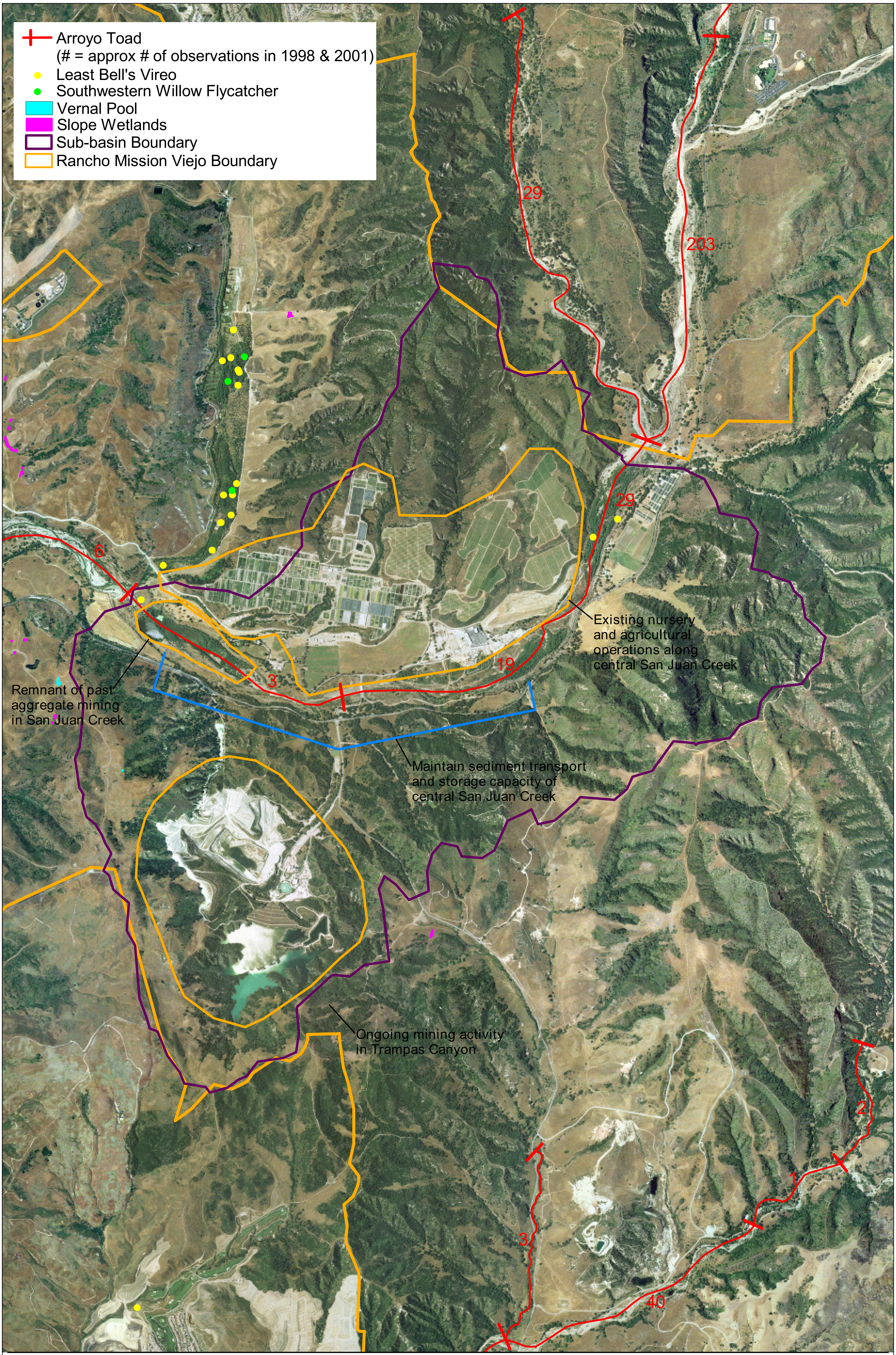


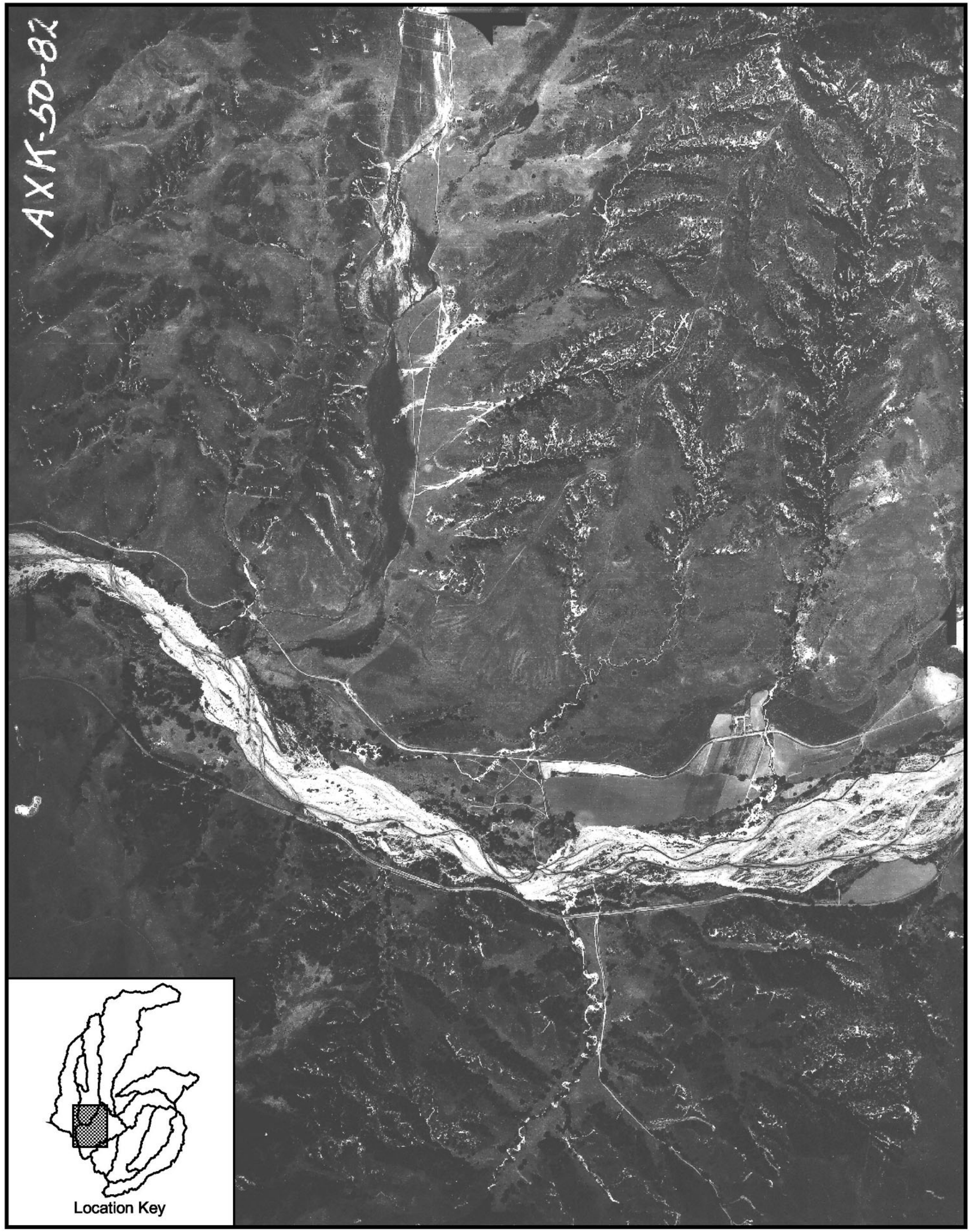
Figure 25
Sub-basin Geomorphic/Hydrologic Features Canada Gobernadora
Opportunities for Restoration/Stabilization and
Water Quality Natural Treatment Systems



Source: Eagle Aerial Imaging 2001 and PCR 2002.

Figure 26
Sub-basin Geomorphic/Hydrologic Features
Central San Juan and Trampas

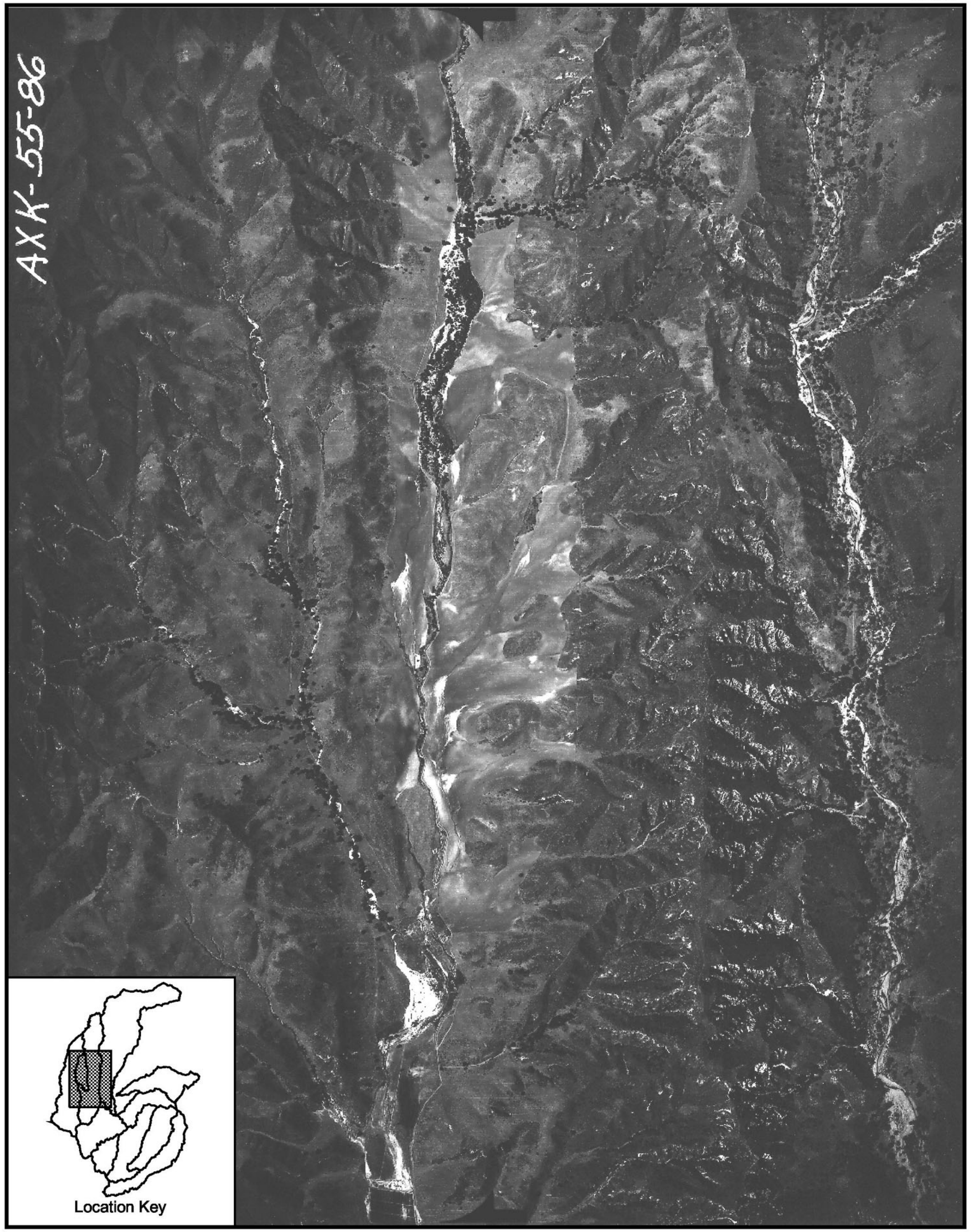
1938



2001

Figure 27
Lower Gobernadora
1938 and 2001 Aerial Photographs

1938



2001

Figure 28
Upper Gobernadora
1938 and 2001 Aerial Photographs

6

iii) Wagon Wheel Sub-basin

WES General Assessment and Conclusions

- Overall Hydrology Integrity is high and Water Quality Integrity is moderate to high.
- Overall Habitat Integrity is moderate.
- Hydrologic regime relatively intact, no channelization or major diversions.
- Riparian floodplain present and relatively intact.
- Perennialized stream flow in the lowest reaches.
- Moderately altered sediment regime.
- Culturally altered buffer in the lowest reaches.

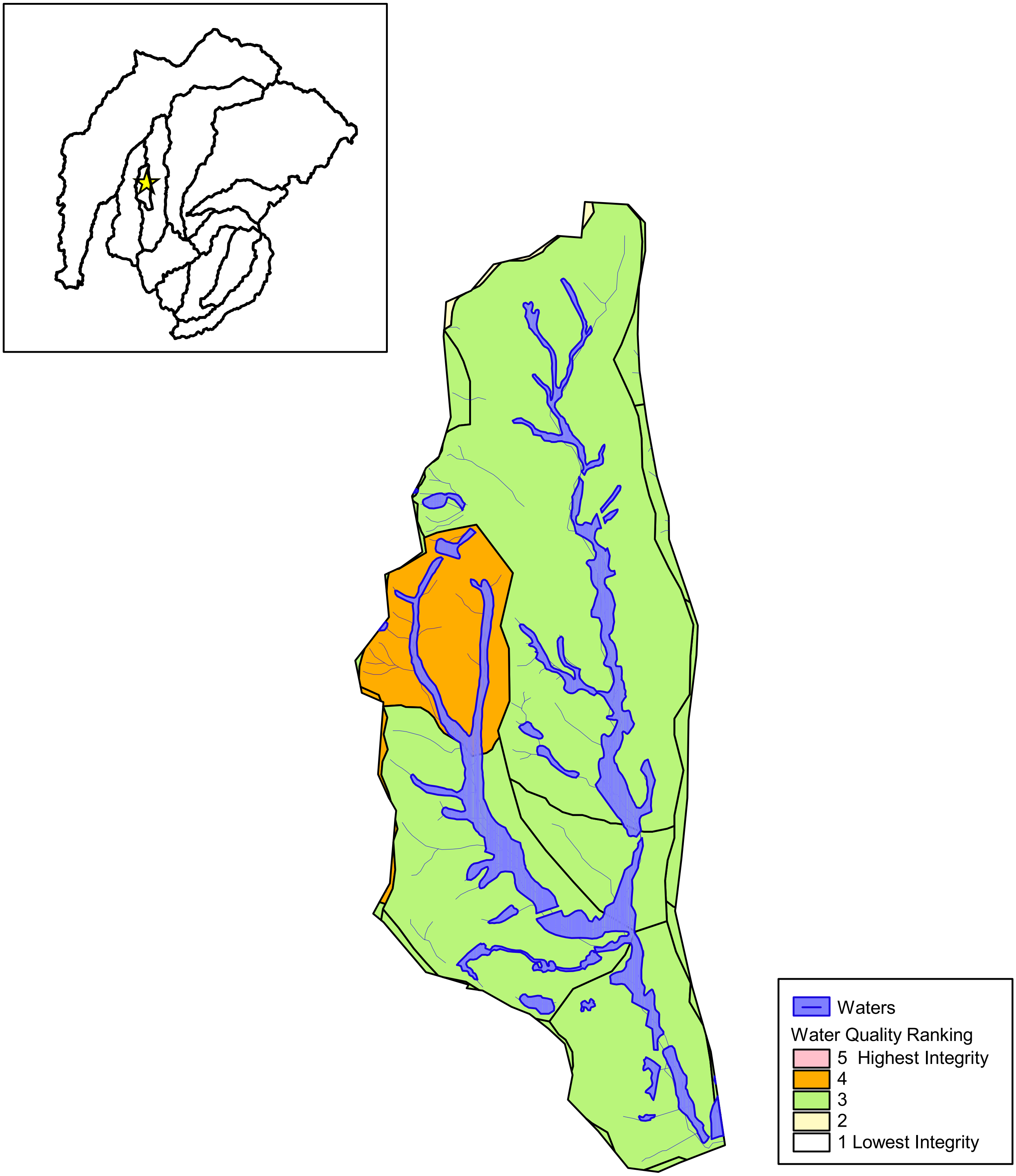
Planning Considerations - Significant Terrains and Hydrologic Features

The Significant Terrains and Hydrologic Features identified, as Planning Considerations for Wagon Wheel are included in the Gobernadora Sub-basin.

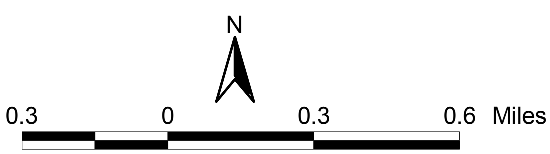
Planning Recommendations

The Planning Recommendations for Wagon Wheel are also included in the Gobernadora Sub-basin.

Figure 29
Wagon Wheel Sub-basin

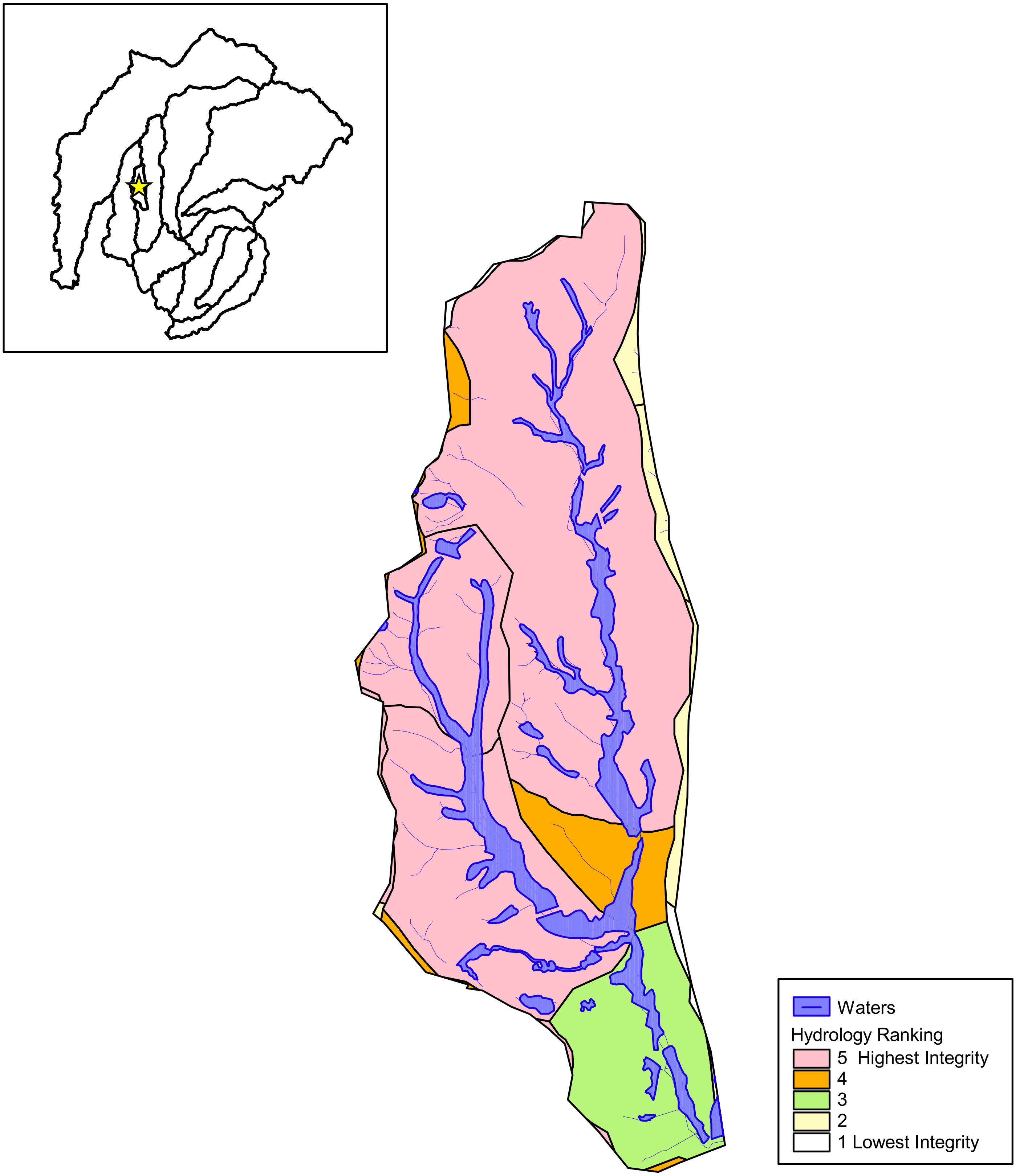


Note: Data from WES Functional Evalution.

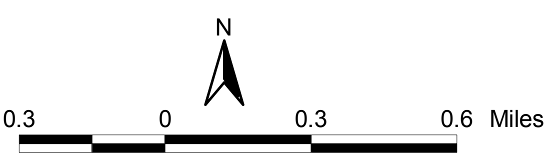


Source: ACOE 2000 and PCR 2002.

Figure 30
Water Quality Integrity Ranking
Wagon Wheel Sub-basin



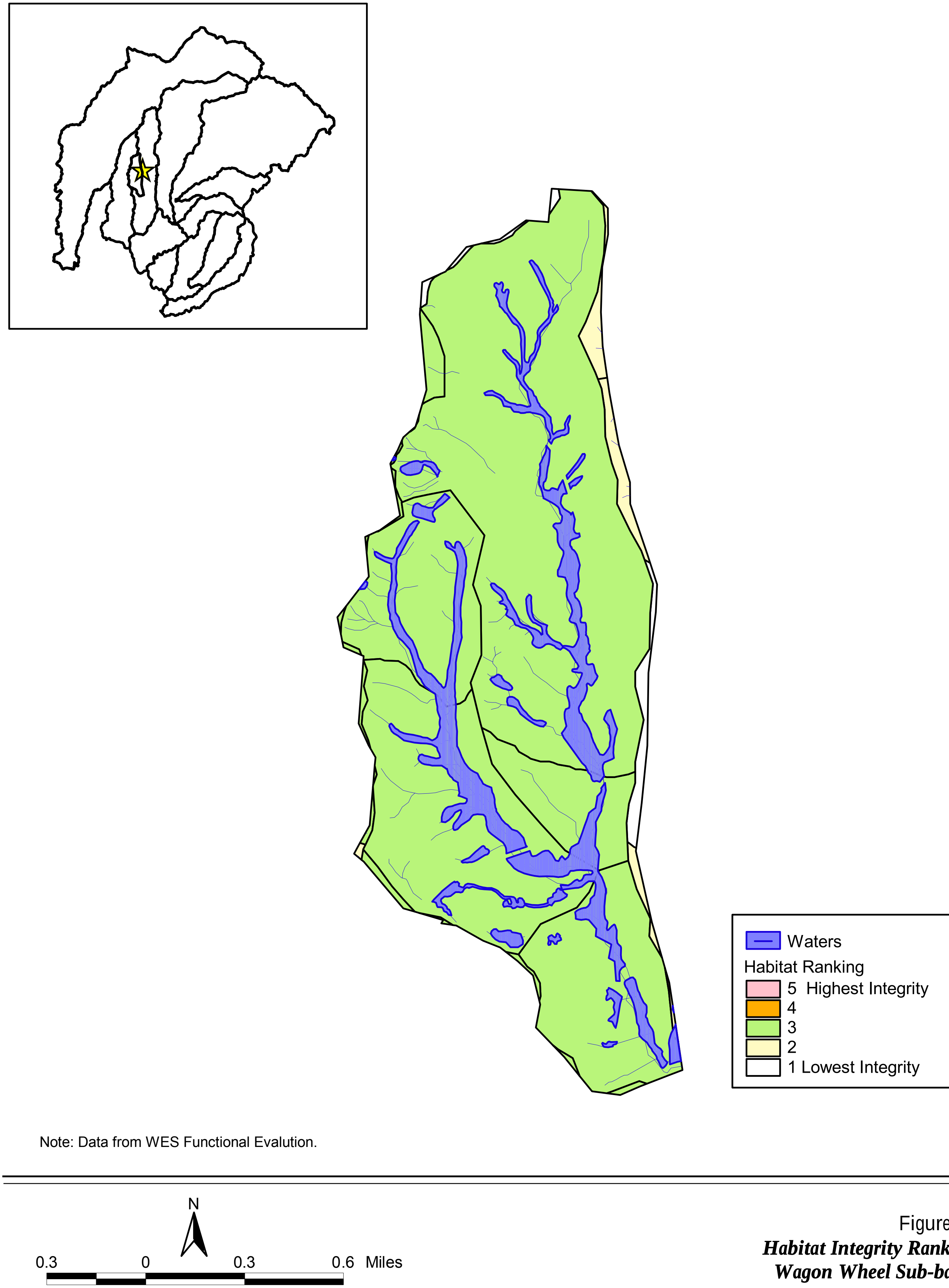
Note: Data from WES Functional Evalution.



Source: ACOE 2000 and PCR 2002.

Figure 31

Hydrology Integrity Ranking
Wagon Wheel Sub-basin



Note: Data from WES Functional Evalution.

Figure 32
Habitat Integrity Ranking
Wagon Wheel Sub-basin

Source: ACOE 2000 and PCR 2002.

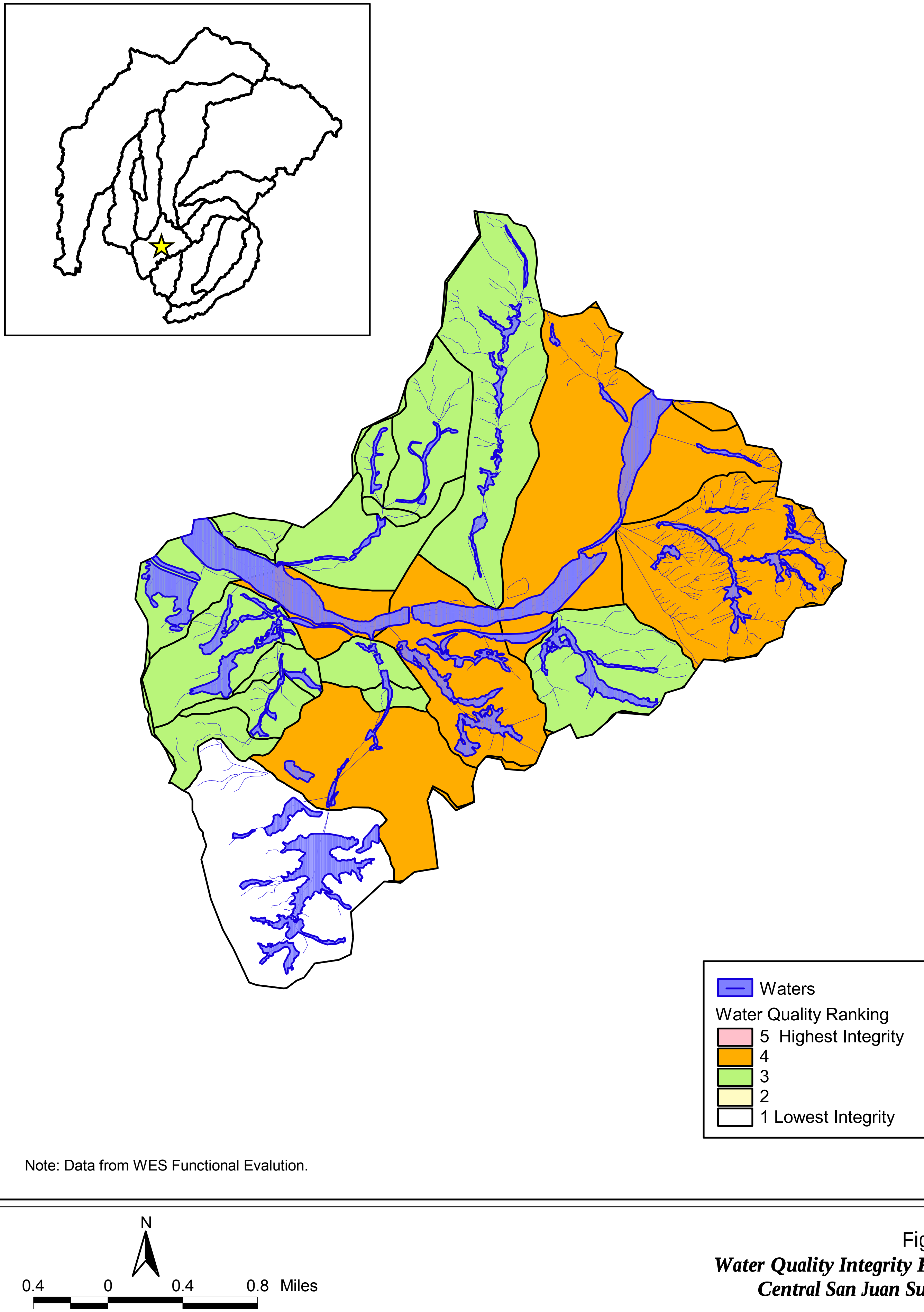
7

iv) Trampas Sub-basin and Central San Juan South of San Juan Creek

Wes General Assessment and Conclusions

- Relatively lower functional integrity, compared to other sub-basins in the study area.
- Overall Hydrology and Water Quality Integrity is moderate.
- Overall Habitat Integrity is low.
- Habitat integrity is affected by the lack of riparian vegetation in the flood prone area, breaks in the riparian corridor, and past adjacent land use practices.
- Most significant impacts result from altered sediment regime and surface water retention in the canyon.

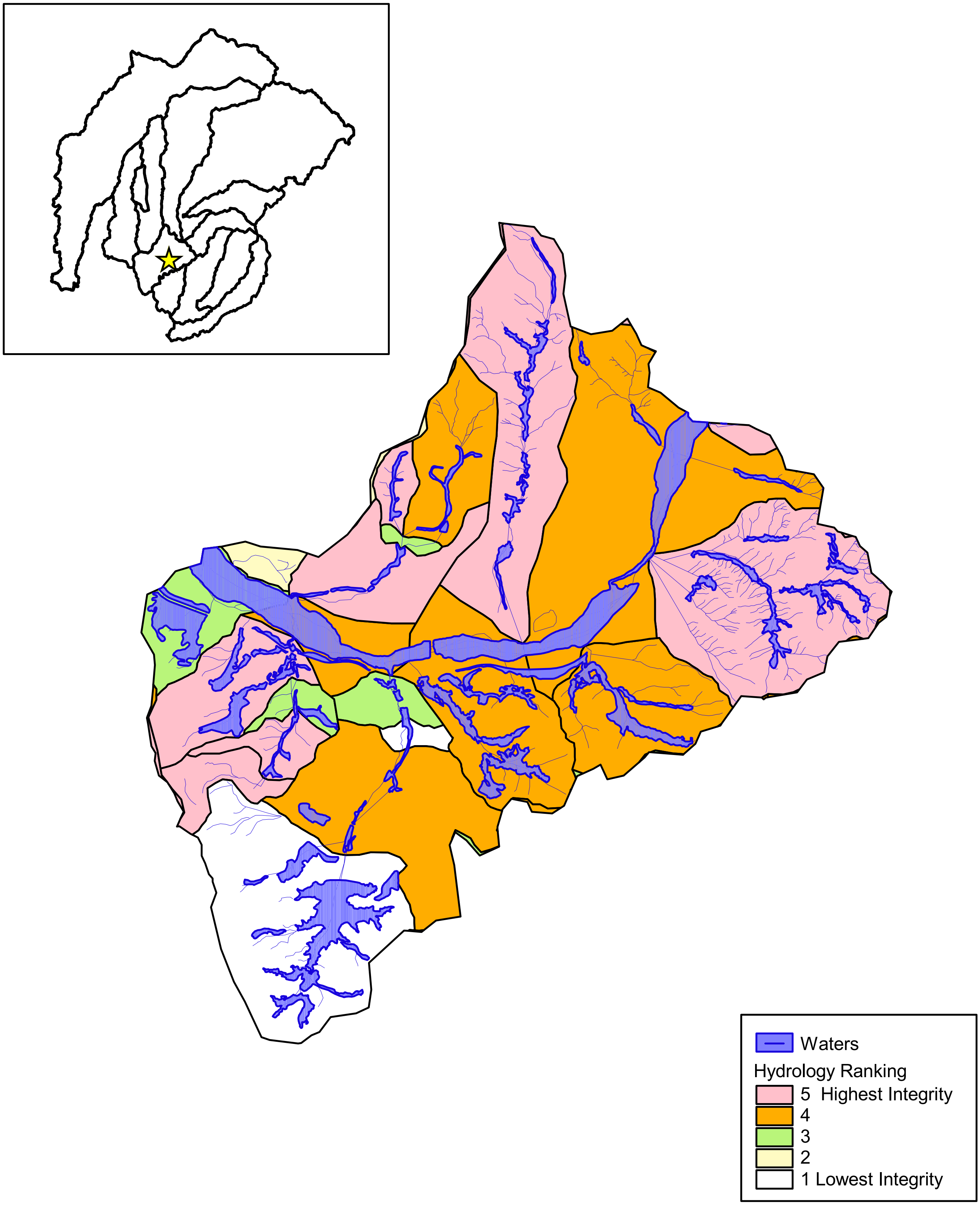
Figure 33
Central San Juan and Trampas Sub-basins



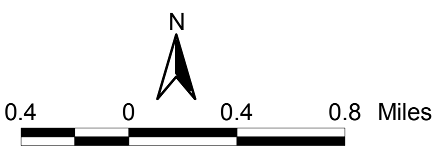
Note: Data from WES Functional Evalution.

Source: ACOE 2000 and PCR 2002.

Figure 34
Water Quality Integrity Ranking
Central San Juan Sub-basin

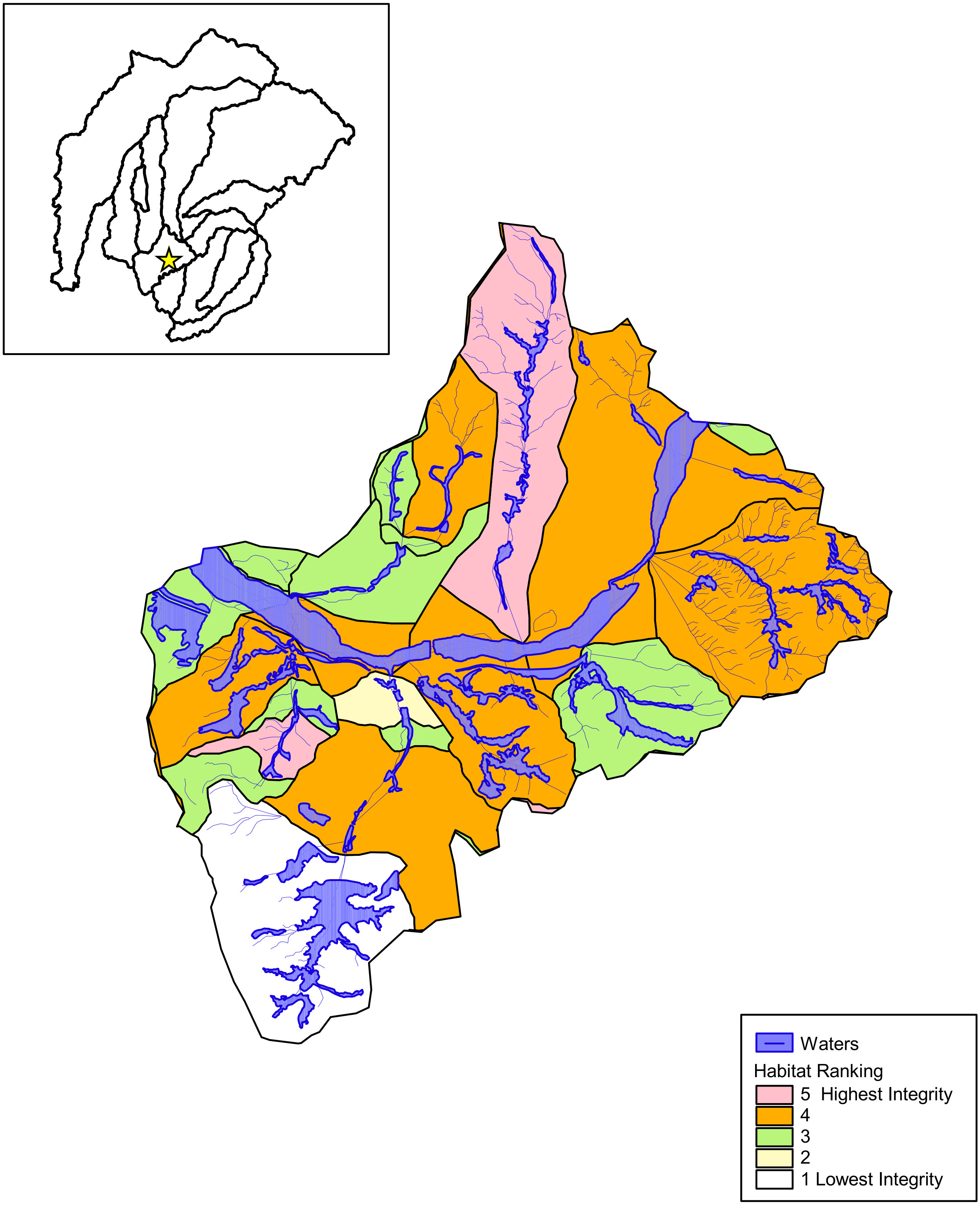


Note: Data from WES Functional Evalution.



Source: ACOE 2000 and PCR 2002.

Figure 35
Hydrology Integrity Ranking
Central San Juan Sub-basin



Note: Data from WES Functional Evalution.

N

0.4 0 0.4 0.8 Miles

Source: ACOE 2000 and PCR 2002.

Figure 36

Habitat Integrity Ranking
Central San Juan Sub-basin

Planning Considerations - Significant Terrains and Hydrologic Features

- Clayey silts and sands that underlie smaller areas east of the Mission Viejo fault have a high propensity for shallow mudflows following periods of extended rainfall.

- The area along Radio Tower Road contains representative wetland types including riverine, alkali marsh, slope wetlands, vernal pool and lacustrine fringe wetlands. The slope wetlands appear to be associated with localized bedrock landslides from the San Onofre and Monterey formations that store groundwater discharge over a prolonged period. The vernal pools are also associated with landslides and support both the federally listed endangered San Diego and the Riversidean fairy shrimp. Manmade stock ponds support fringing lacustrine wetlands. Riverine reaches within this area are generally high-gradient, low-order streams characterized as steep canyons dominated by sycamore or willow riparian forest. Some areas appear to have perennial or near-perennial flow.

- Focus development in Trampas Canyon in disturbed and adjacent areas with low to moderate hydrologic, water quality and habitat integrity function and value.

- Sand, hard rock and minerals have been mined from Trampas Canyon over the last 50 years. An artificial lake dominates this sub-basin. The lake is steep-sided, relatively deep and the uplands surrounding the artificial lake are dominated by ruderal vegetation.

- Runoff and baseflow from Trampas Creek may contribute to supporting a small arroyo toad population near its confluence with San Juan Creek.

Planning Recommendations

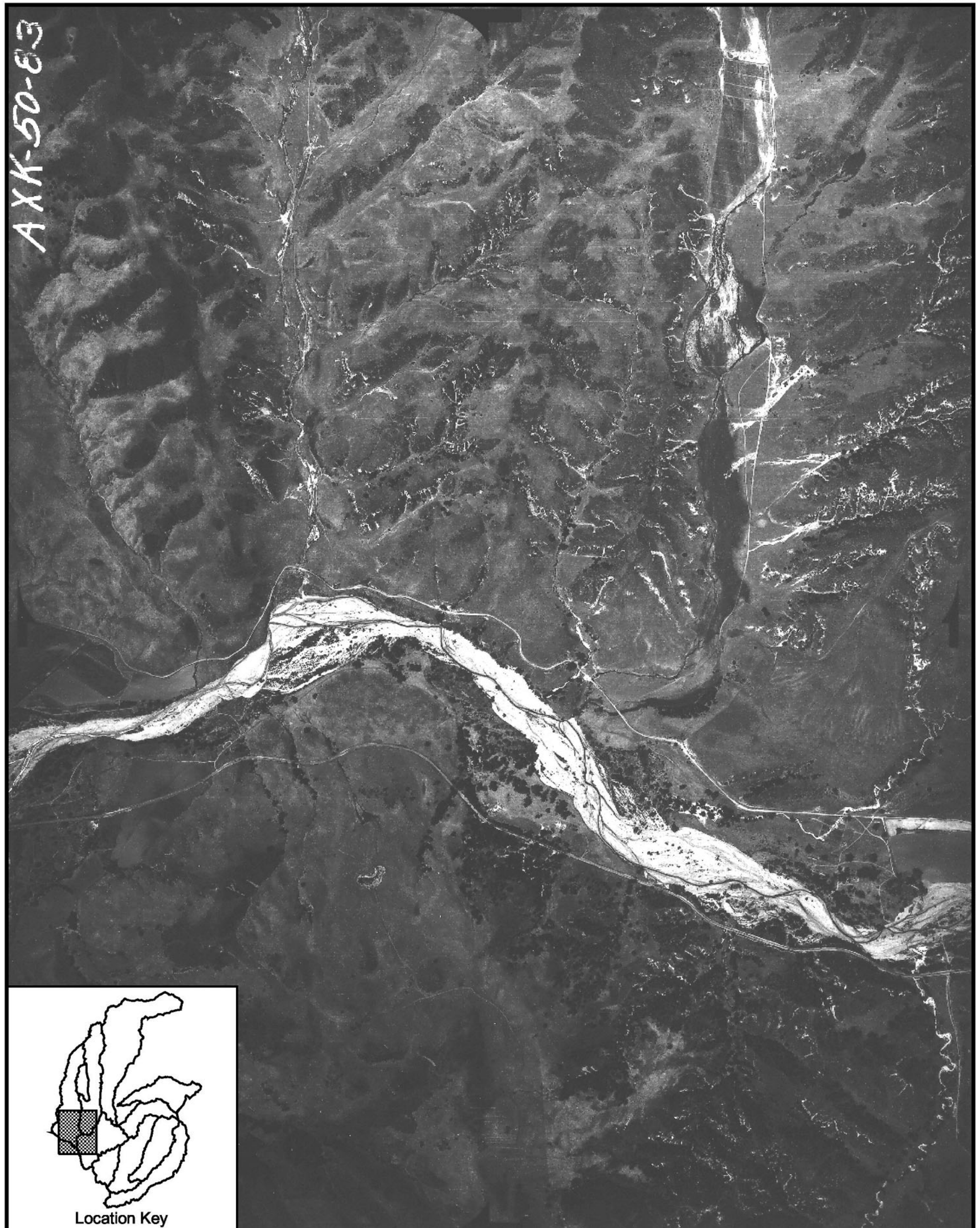
- Trampas Canyon is suitable for development.

- The area along Radio Tower Road should be protected because it contains a diversity of wetland types and endangered fairy shrimp in close proximity to one another, thereby increasing the heterogeneity of the landscape from an aquatic resources perspective.

- Stormwater flows from Trampas Creek into San Juan Creek should be managed to provide flows comparable to existing conditions.

Figure 37
Sub-basin Geomorphic/Hydrologic Features
Central San Juan and Trampas

1938

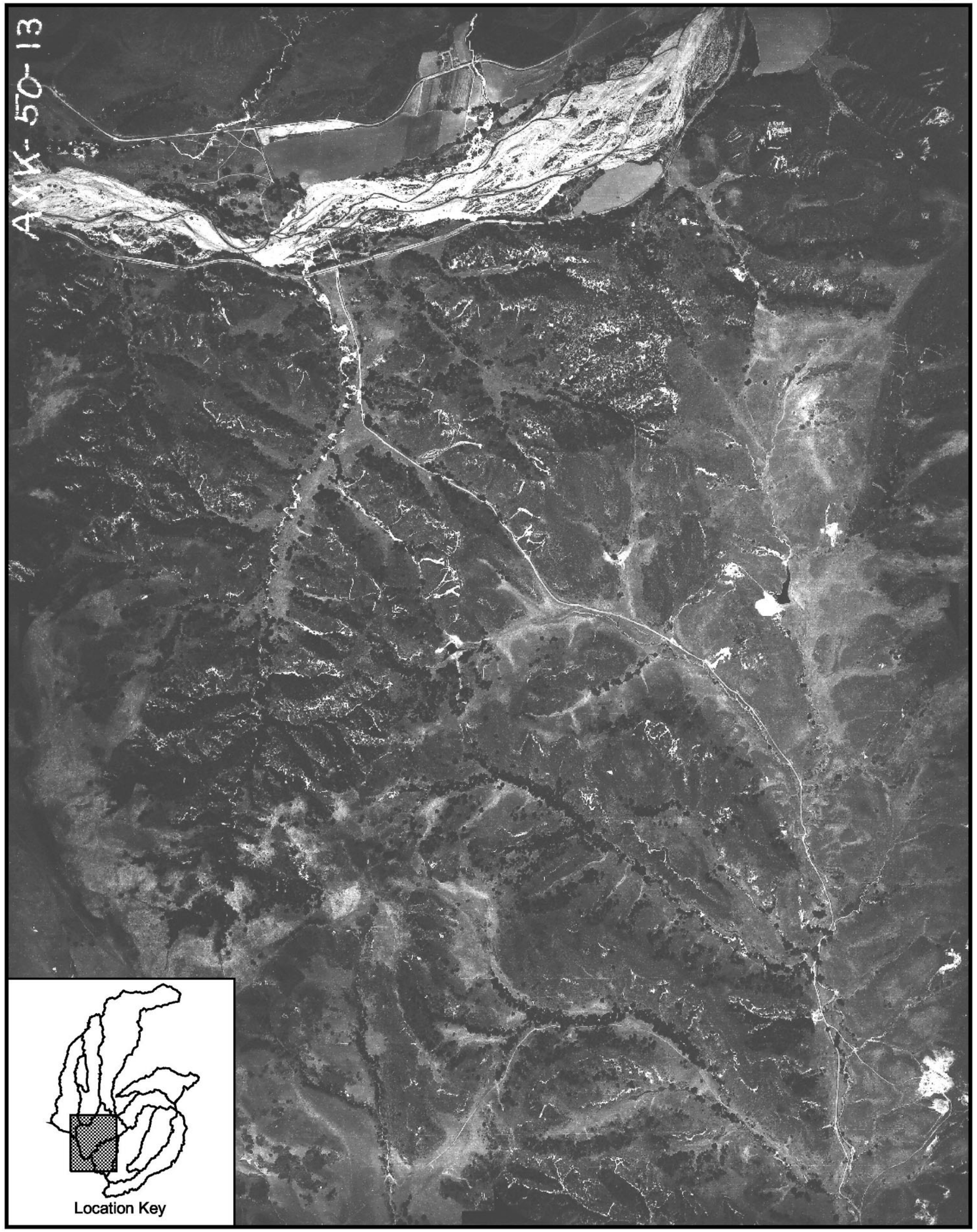


2001

Figure 38
Central San Juan (West)
1938 and 2001 Aerial Photographs

Figure 39
Central San Juan (East)
1938 and 2001 Aerial Photographs

1938



2001

Figure 40
Trampas
1938 and 2001 Aerial Photographs

8

v) Verdugo Sub-basin

WES General Assessment and Conclusions

- High scores for almost all indicators; overall, Verdugo Canyon received the highest integrity scores of any sub-basin evaluated.
- Overall Hydrology and Water Quality Integrity is very high.
- Overall Habitat Integrity is high.
- In lower portion of creek, a few locations with an opportunity to increase the riparian buffer.
- Moderately altered sediment regime in some locations.

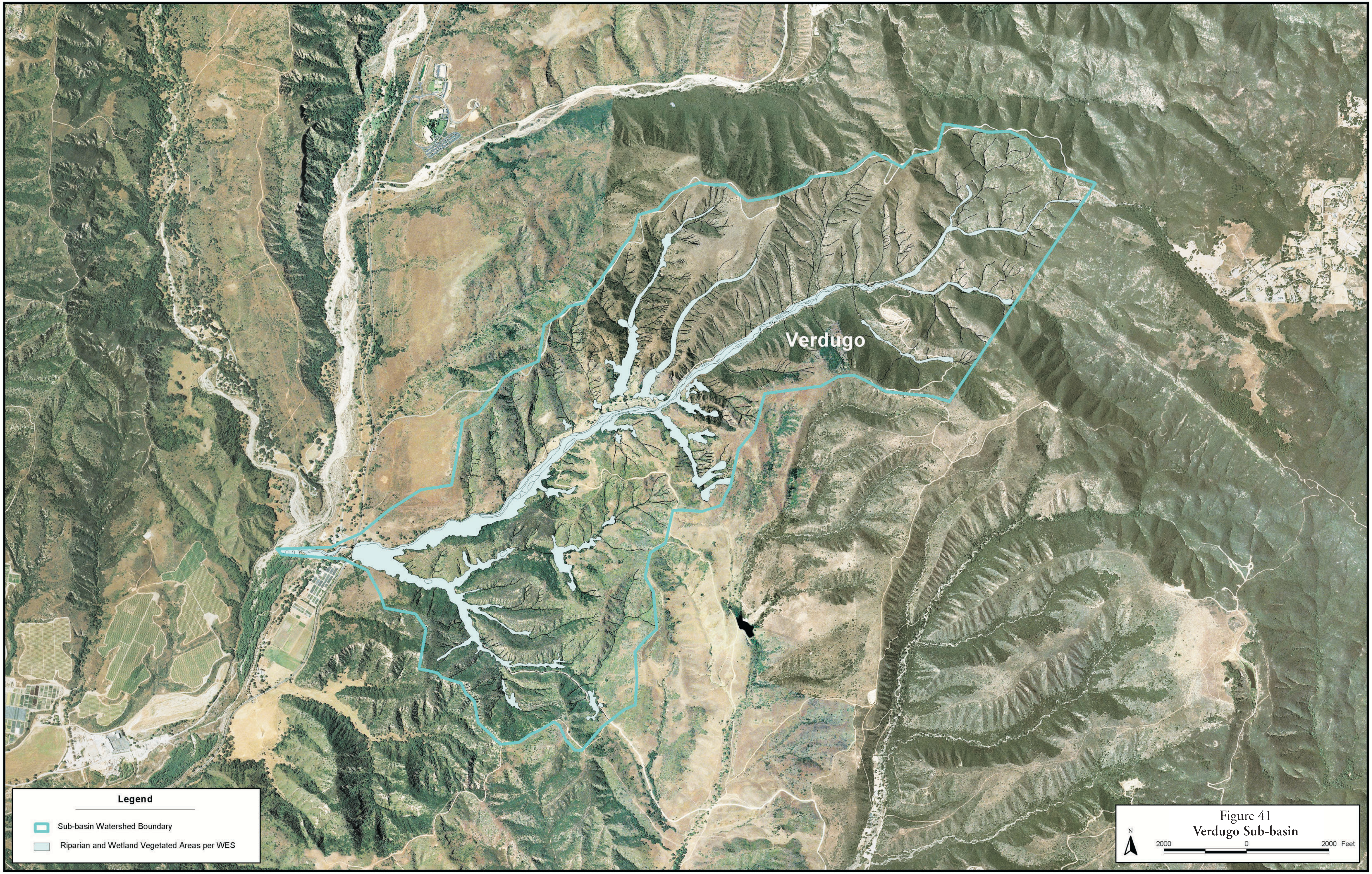
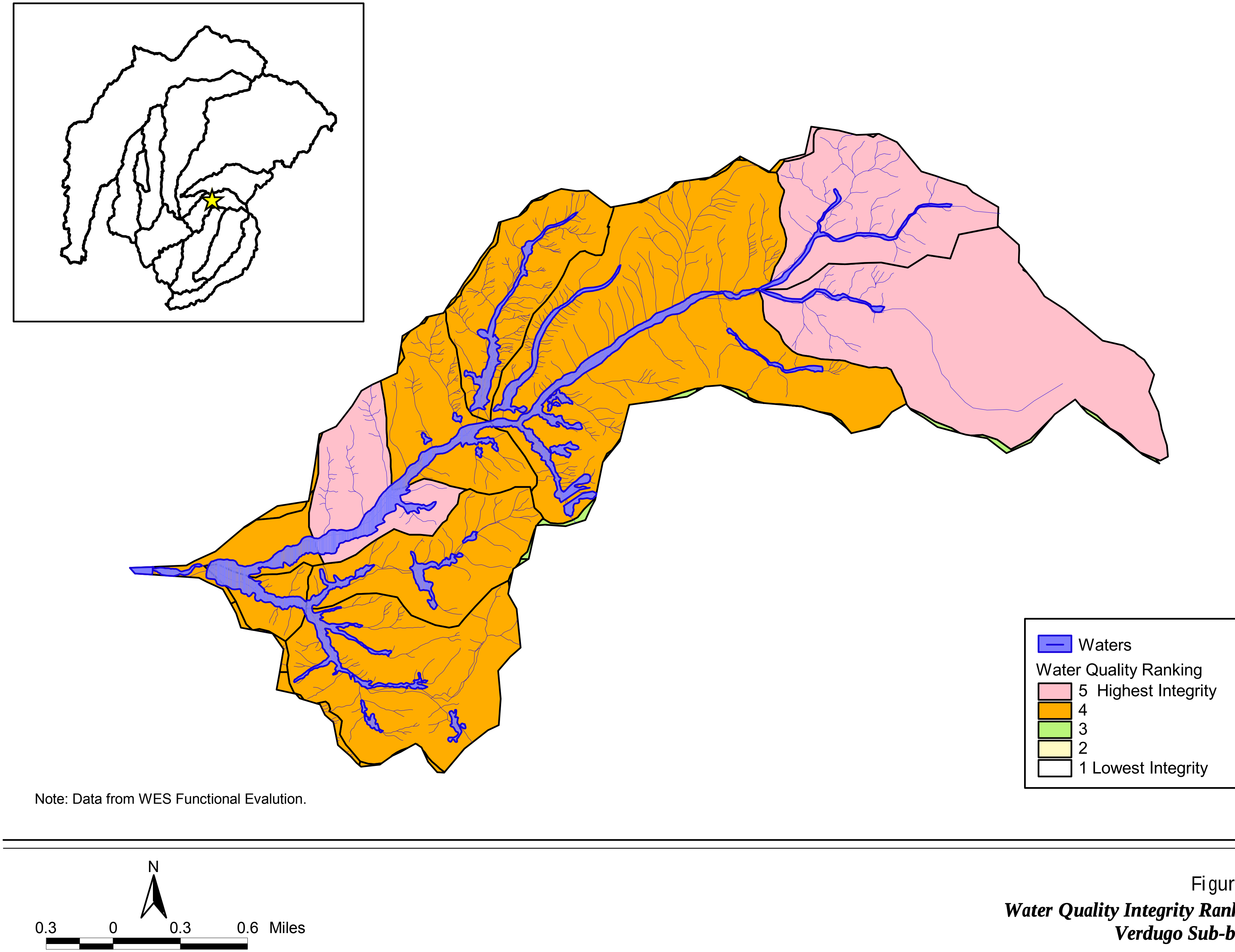


Figure 41
Verdugo Sub-basin

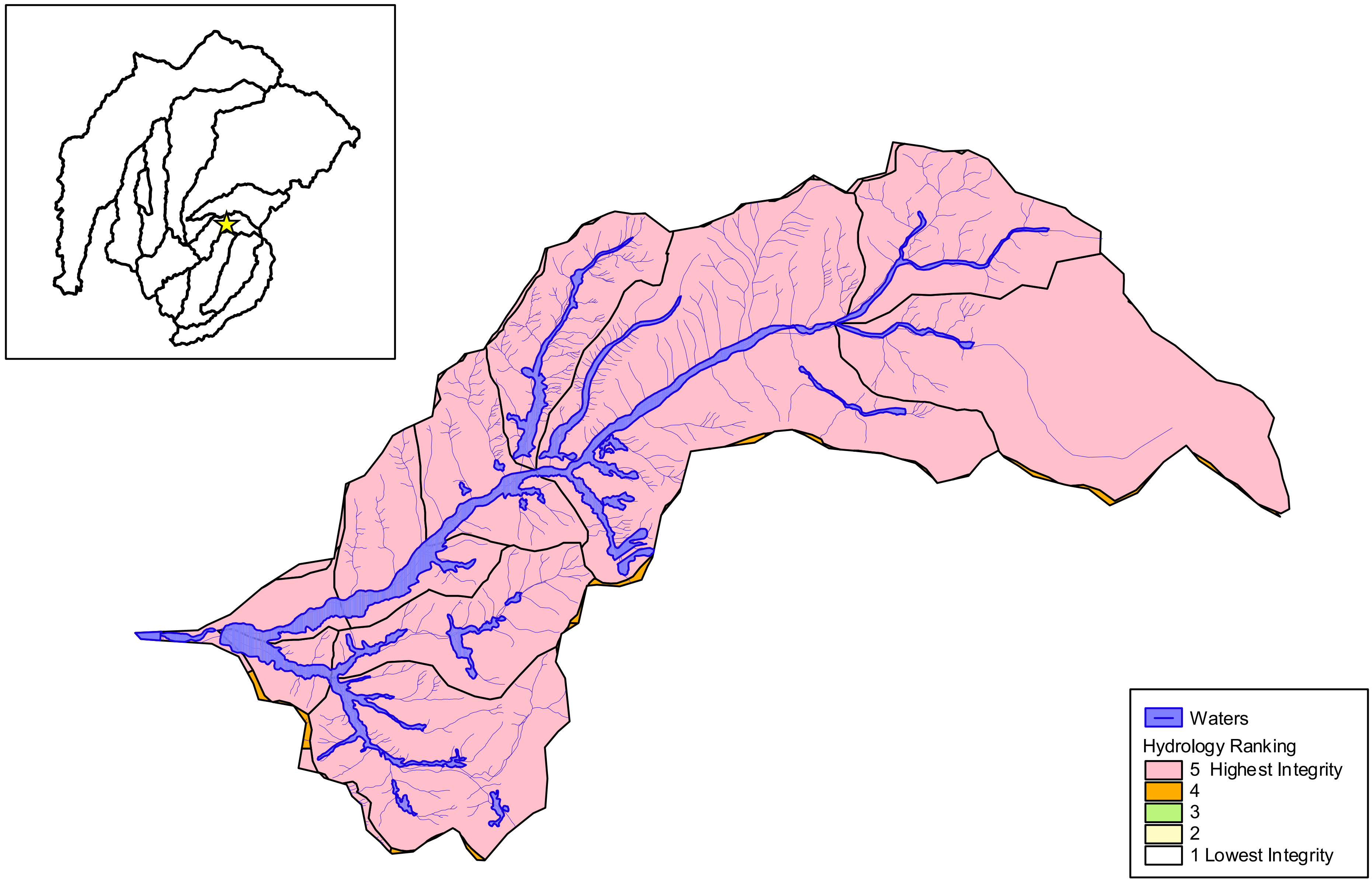


Note: Data from WES Functional Evalution.

Source: ACOE 2000 and PCR 2002.

Figure 42

Water Quality Integrity Ranking Verdugo Sub-basin



Note: Data from WES Functional E valution.

N

0.3 0 0.3 0.6 Miles

Source: ACOE 2000 and PCR 2002.

Figure 43

Hydrology Integrity Ranking
Verdugo Sub-basin

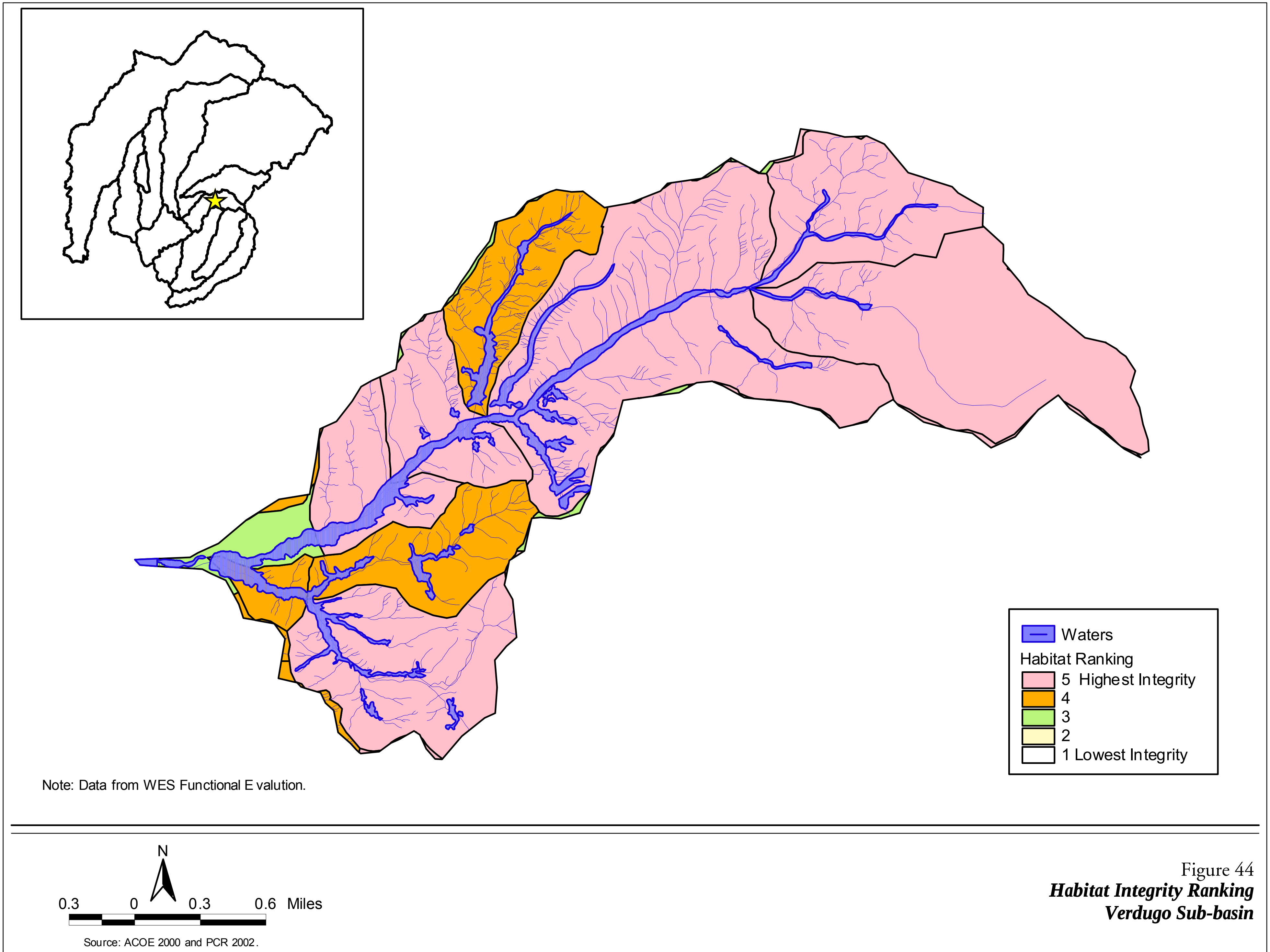


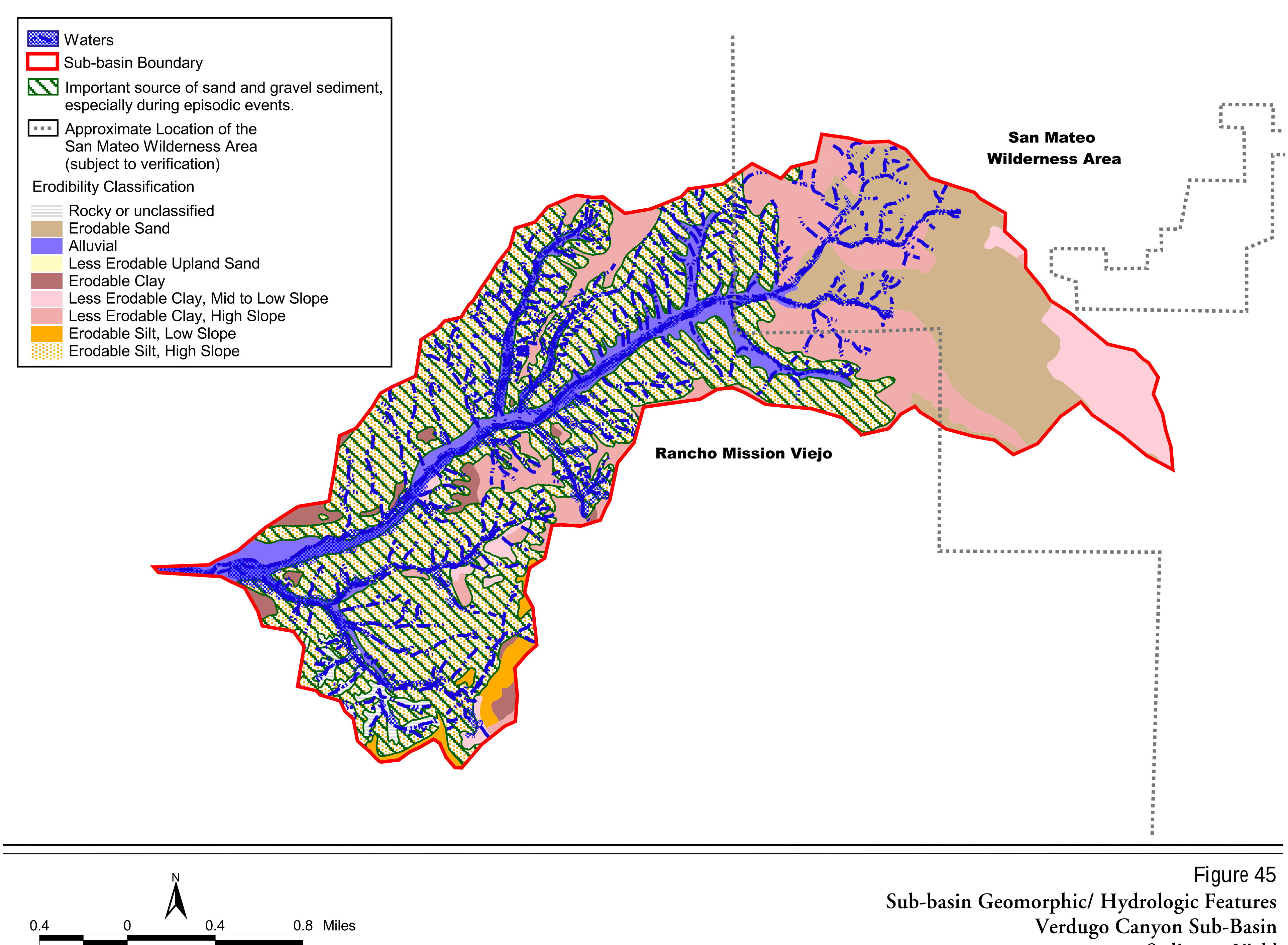
Figure 44
Habitat Integrity Ranking
Verdugo Sub-basin

Planning Considerations - Significant Terrains and Hydrology Features

- Verdugo Canyon has one of the highest soil infiltration rates of any of the sub-basins studies in the San Juan watershed.
- Substrate types and slope result in Verdugo Canyon having the highest sediment transport rate per unit area of any San Juan Creek watershed sub-basin, with sediment yield second behind Bell Canyon. Much of the sediment in Verdugo is mobilized during episodic events and, when mobilized, has the potential to have substantial effects on sediment delivery and on the geomorphology of downstream areas.
- The large quantities of highly erodible soils in the Verdugo Sub-basin are expected to provide a source of phosphorus loading to San Juan Creek.
- The upper portion of the Verdugo Sub-basin is underlain by the Trabuco and Ladd formations, which lack shallow groundwater and yield little baseflow. Due to the relative absence of groundwater and the presence of the steep slopes, both upland and riparian habitats reflect drier conditions than in other sub-basins.
- The stream course has a predominantly coarse substrate and is strongly influenced by the narrowness of the canyon.

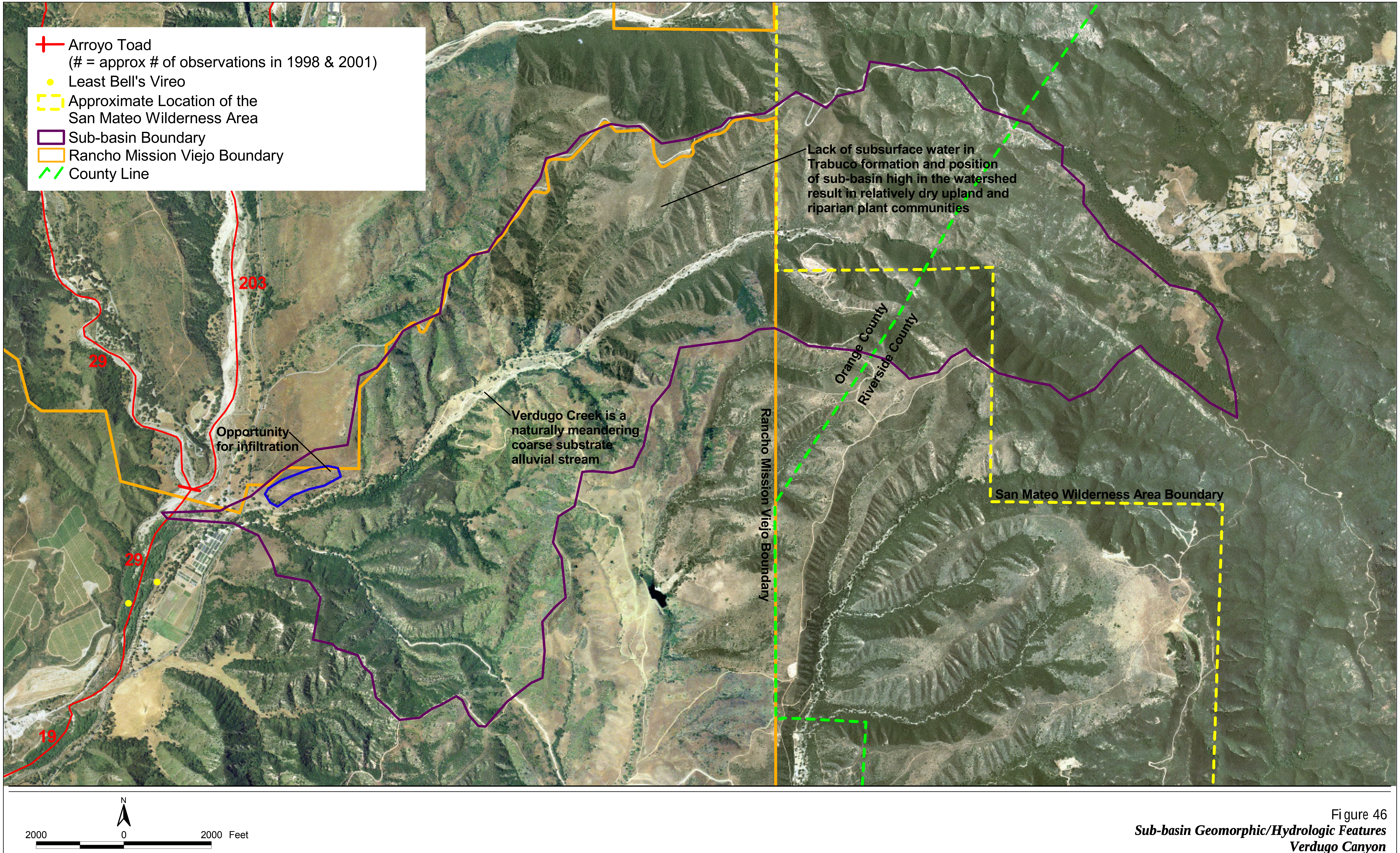
Planning Recommendations

- Development with impervious surfaces should be limited in extent in order to protect the generation and transport of sediment to downstream areas, and to protect Verdugo Canyon from excessive erosion.
- Development should be set back from significant riparian habitat within the relatively narrow and geologically confined floodplain.
- Infiltration functions should be protected through site design. Cumulative stormwater flows should be managed in such a way as to not change peak flows that under present conditions lag behind those of the main stem of San Juan Creek. The area adjacent to the mouth of Verdugo Canyon provides opportunities for infiltration and flow attenuation.



Source: ACOE,PWA, BH 2000 and PCR 2002.

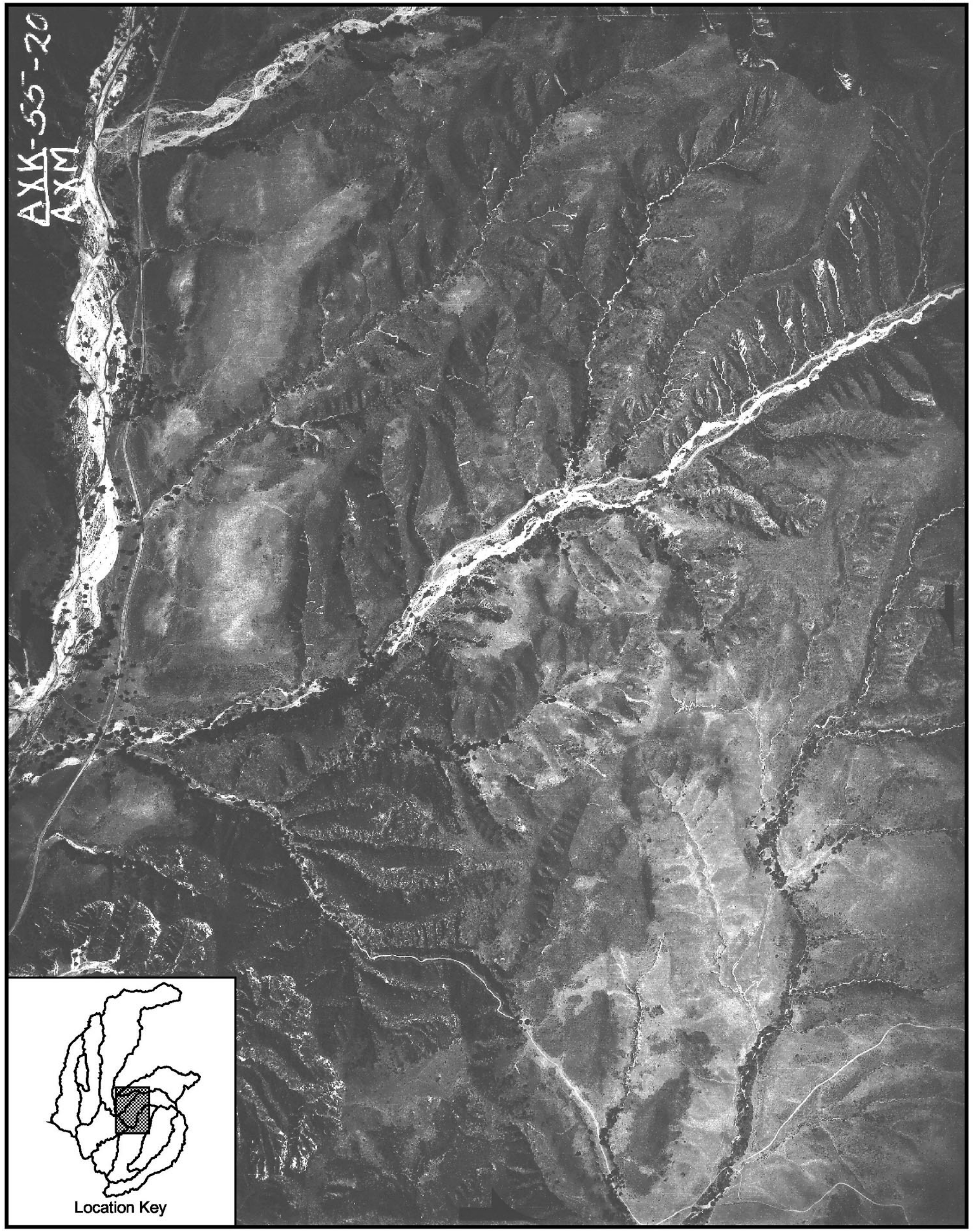
Figure 45
Sub-basin Geomorphic/ Hydrologic Features
Verdugo Canyon Sub-Basin
Sediment Yield



Source: Eagle Aerial Imaging 2001 and PCR 2002.

Figure 46
Sub-basin Geomorphic/Hydrologic Features
Verdugo Canyon

1938



2001

Figure 47
Verdugo
1938 and 2001 Aerial Photographs

9

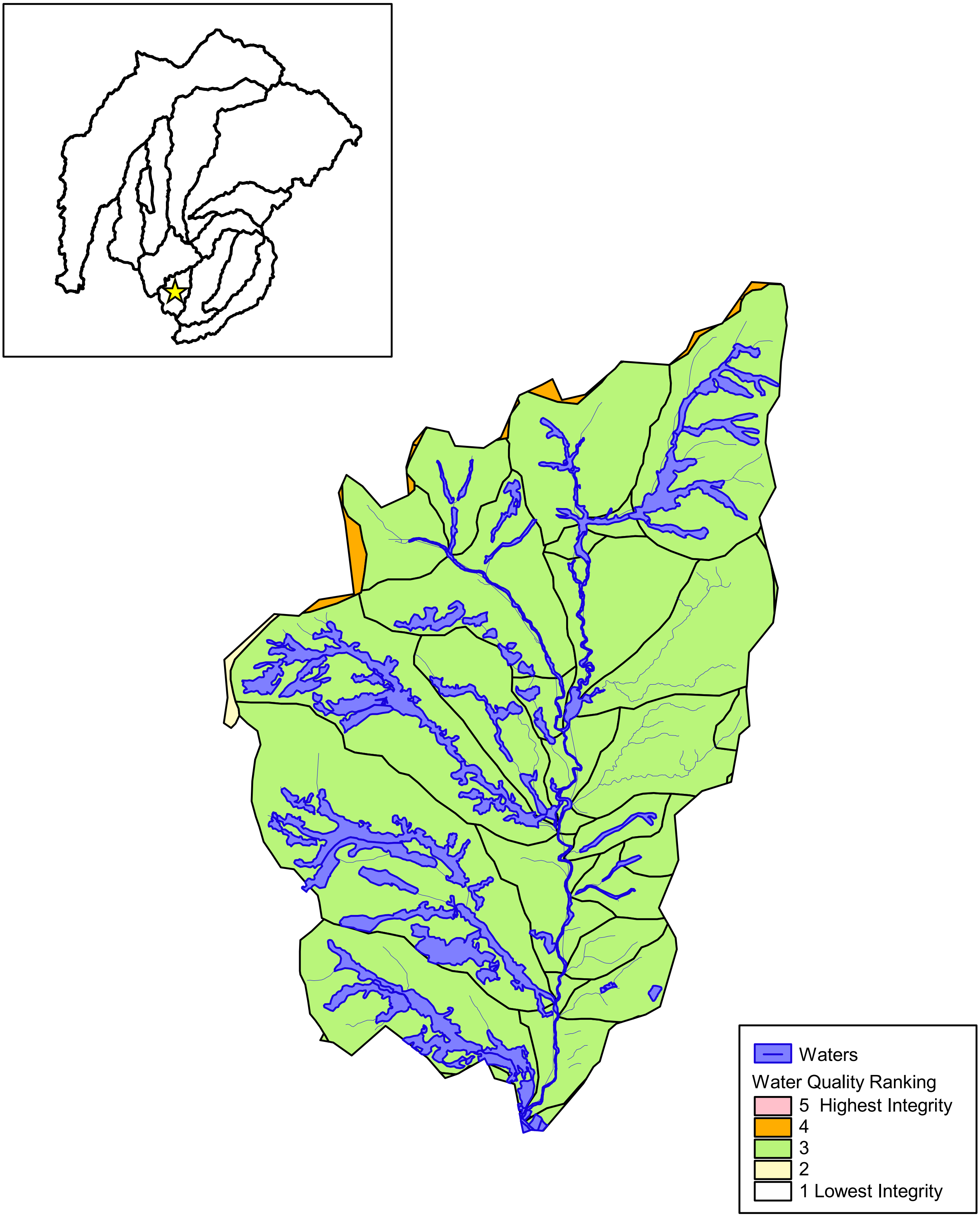
2B. SAN MATEO WATERSHED

i) Cristianitos Sub-basin

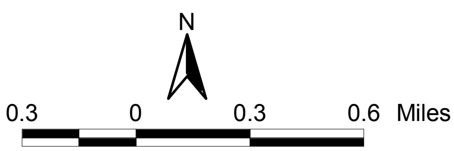
WES General Assessment and Conclusions

- Overall Hydrology and Water Quality Integrity is moderate to high.
- Overall Habitat Integrity is moderate.
- The hydrologic regime is relatively intact, no channelization or major diversions.
- Relatively contiguous riparian corridor in the main canyon.
- Very poor interaction between the channel and the floodplain throughout the length of the creek and portions of the creek has reduced riparian vegetation in the floodplain area.
- Culturally altered buffer area (due to the road), especially in more upstream areas result in reduced habitat integrity.
- Several locations of riparian corridor breaks (associated with road crossings).
- Moderately altered sediment regime.
- Upland land use poses a risk of nutrient, pesticide, and sediment loadings to the creek.

Figure 48
Cristianitos Sub-basin



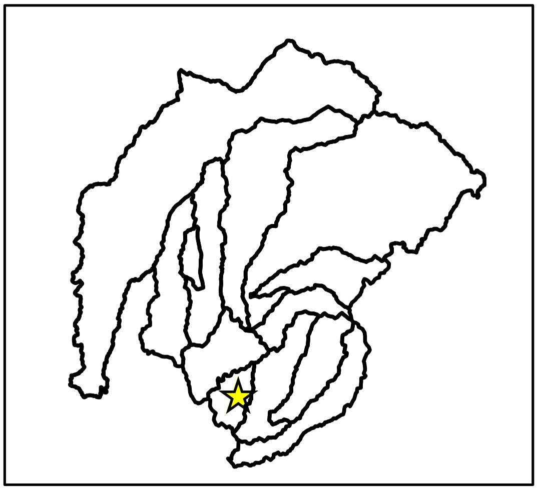
Note: Data from WES Functional Evalution.

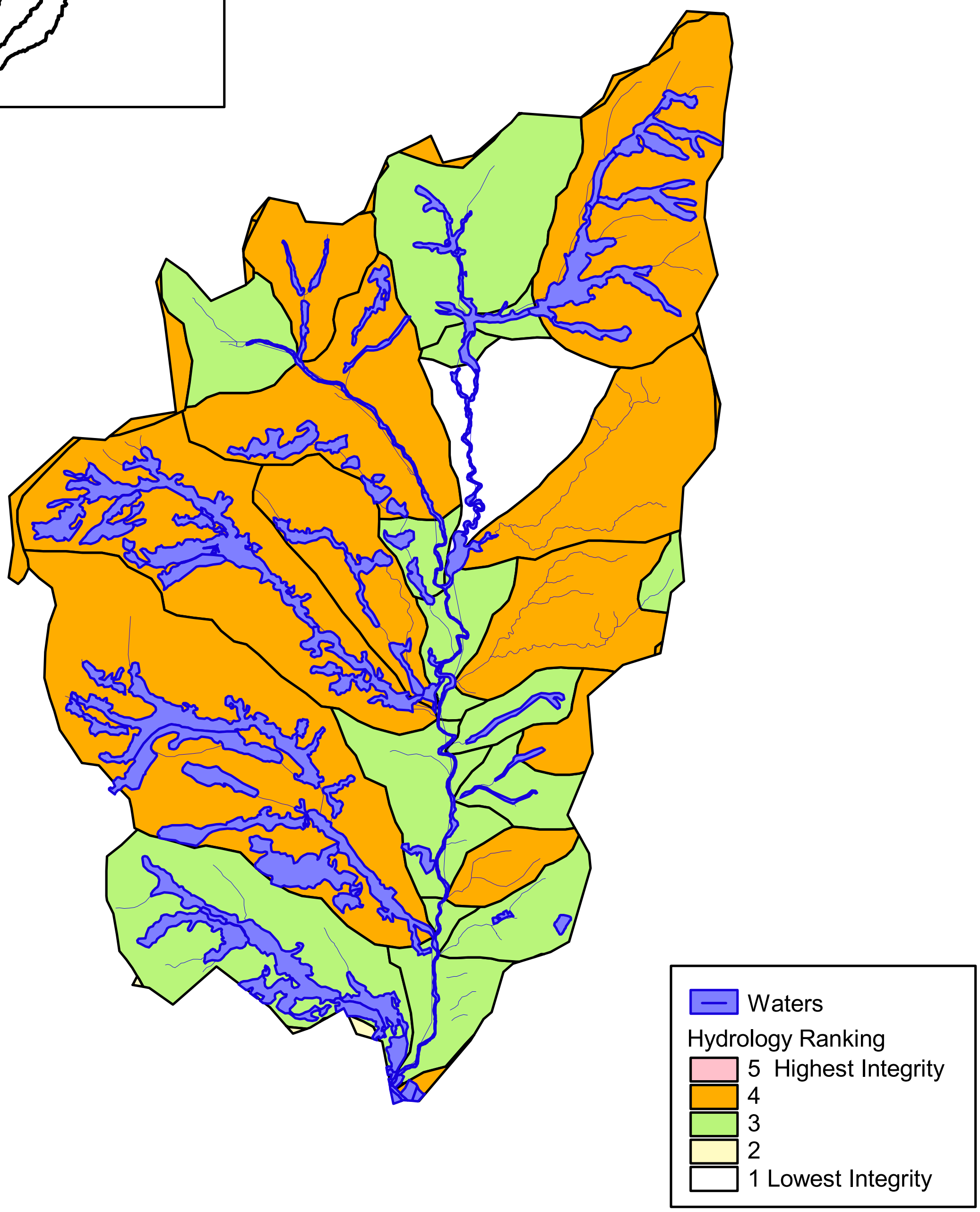


Source: ACOE 2000 and PCR 2002.

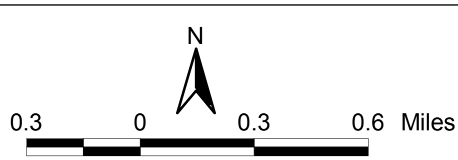
Figure 49

Water Quality Integrity Ranking
Cristanitos Sub-basin



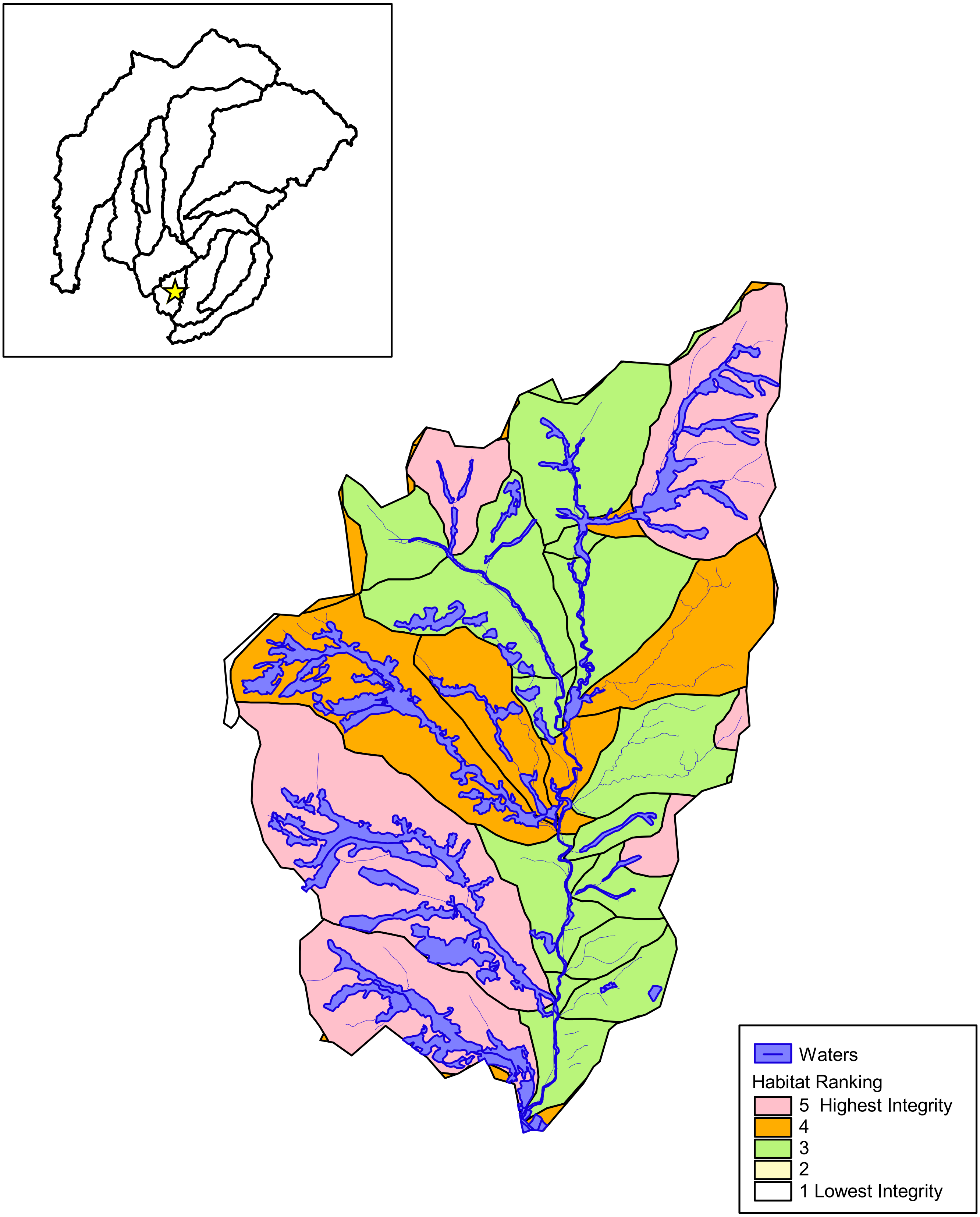


Note: Data from WES Functional Evalution.

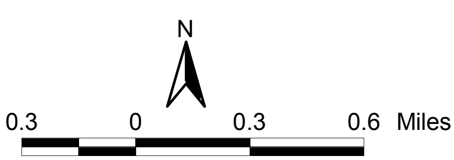


Source: ACOE 2000 and PCR 2002.

Figure 50
Hydrology Integrity Ranking
Cristanitos Sub-basin



Note: Data from WES Functional Evalution.



Source: ACOE 2000 and PCR 2002.

Figure 51

Habitat Integrity Ranking
Cristanitos Sub-basin

Planning Considerations - Significant Terrains and Hydrology Features

- Cristianitos Sub-basin has a less "flashy" hydrograph than other sub-basins of the western San Mateo Watershed due to its shape, infiltration characteristics, and drainage network.

- The terrains to the west of Cristianitos Creek are generally erodible silty sands while the terrains to the east of the Creek are generally less erodible clays (where not disturbed). Intact clayey terrains tend to seal and functionally become nearly impervious upon saturation, generating more rapid runoff than sandy terrains.

- Major riparian areas exist in the northeast and southwest portions of the sub-basin.

- The middle and lower areas to the east of the creek contain few riparian areas and include numerous former open clay pits that are eroding and are not self healing.

- The middle portion of Cristianitos Creek supports alkaline wetlands. The hydrologic support of these wetlands in relation to the surface and subsurface hydrology of this portion of Cristianitos Creek is not fully understood, however, recently installed groundwater monitoring wells will help clarify this issue.

- The clay-rich soils to the east of the creek generate fine sediments, generally silts and clays, which contribute to turbidity in downstream waters (as contrasted with coarser sediments such as sands, silty sands, and cobbles contributed by Gabino and La Paz).

- A review of 1938 aerial photos indicates that the mainstem of Cristianitos Creek upstream from the confluence with Gabino Creek appears to have been deepening over the past 60 years.

Planning Recommendations

- The headwater area should be protected, with new impervious surfaces limited in extent within the headwater area.

- Where feasible, protected headwater areas should be targeted for restoration of native vegetation to reduce the generation of fine sediments from the clayey terrains and to promote infiltration, and to enhance the value of upland habitats adjacent to the streams.

- In order to emulate existing hydrologic conditions, development should focus on areas with clayey soils, which presently seal fairly quickly under storm conditions and have relatively high runoff rates. The overall goal should be to reduce the generation of fine sediments compared with existing conditions to reduce turbidity effects and other adverse impacts of fine sediments on downstream aquatic resources. Development in the middle and lower reach areas should be set back from the Creek and should be located in higher areas to the east of the Creek where existing erosion could be concurrently addressed.

- Stream stabilization opportunities should be examined in Cristianitos Creek (above the confluence with Gabino Creek) in the context of longer-term geologic processes.

- The alkali wetlands within the middle portion of the sub-basin should be protected in conjunction with protection of the overall riparian system.

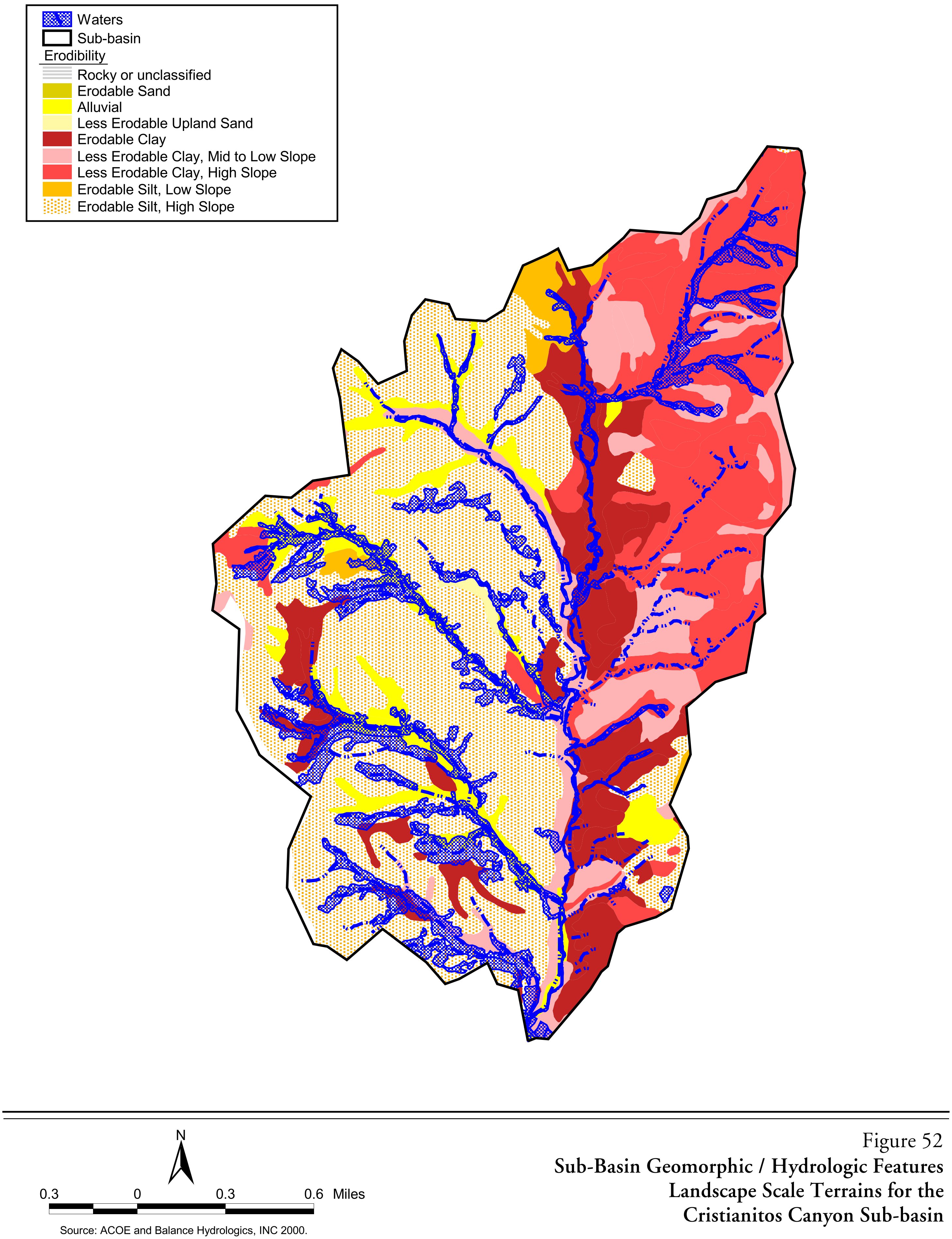


Figure 52
Sub-Basin Geomorphic / Hydrologic Features Landscape Scale Terrains for the Cristianitos Canyon Sub-basin

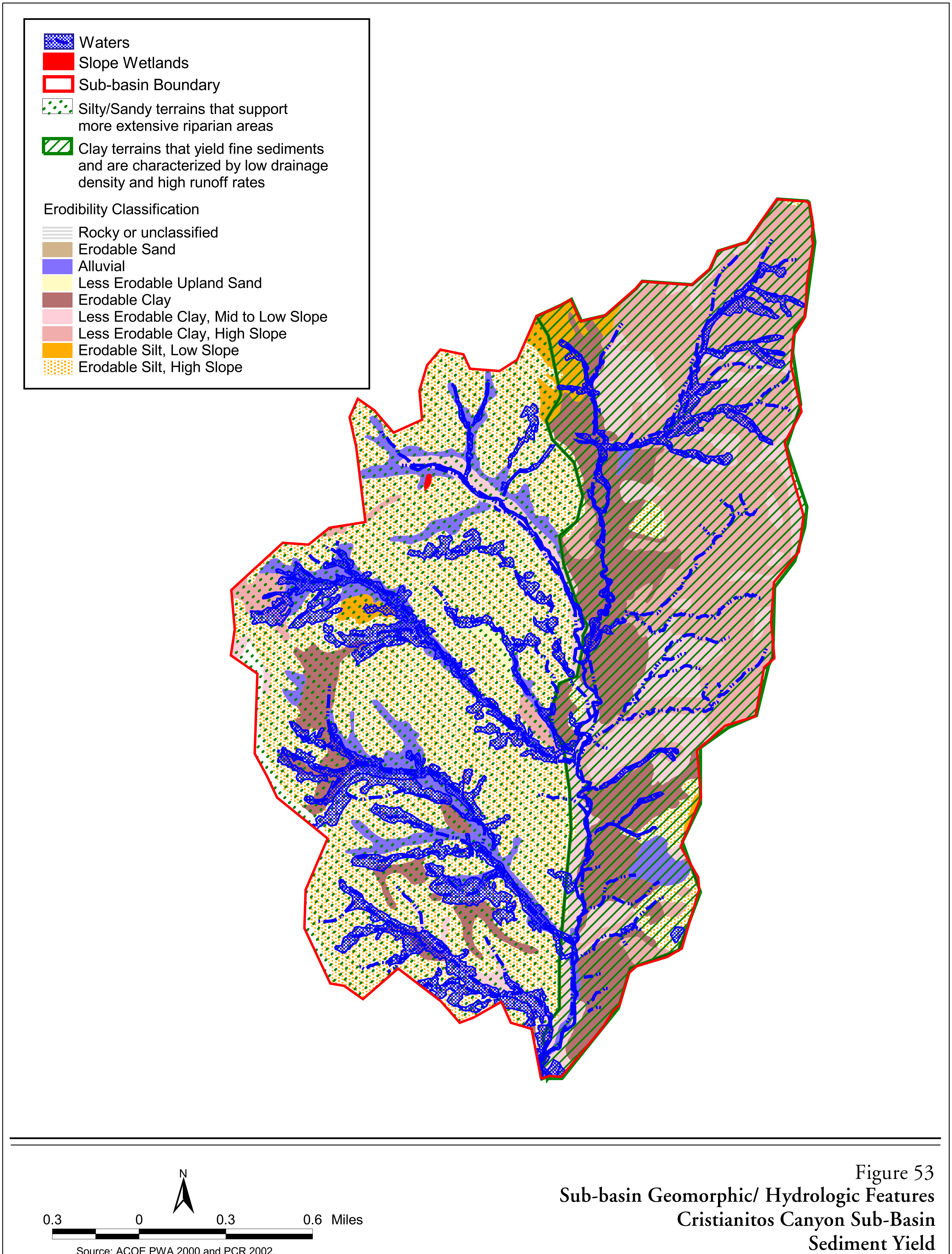
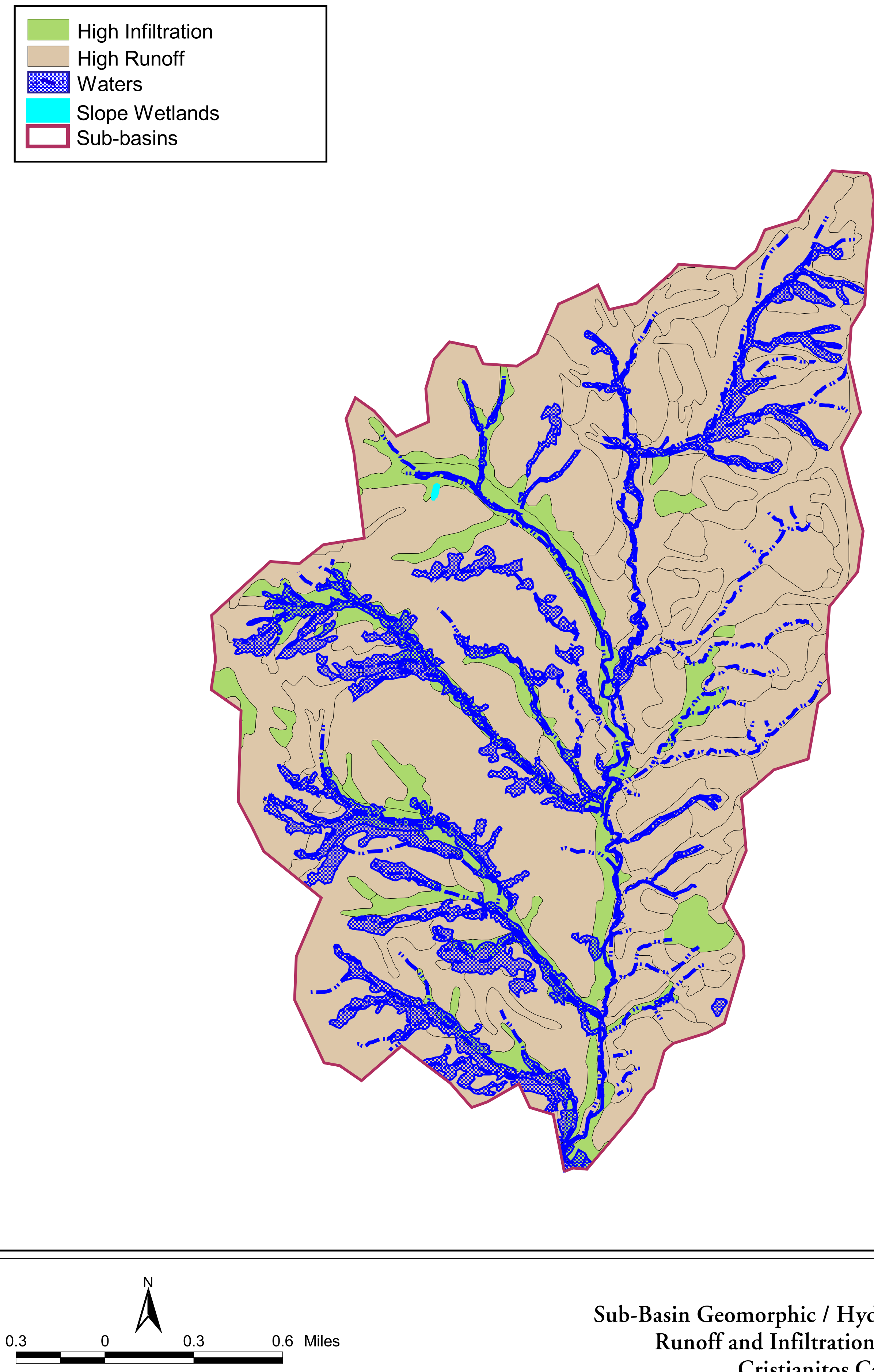
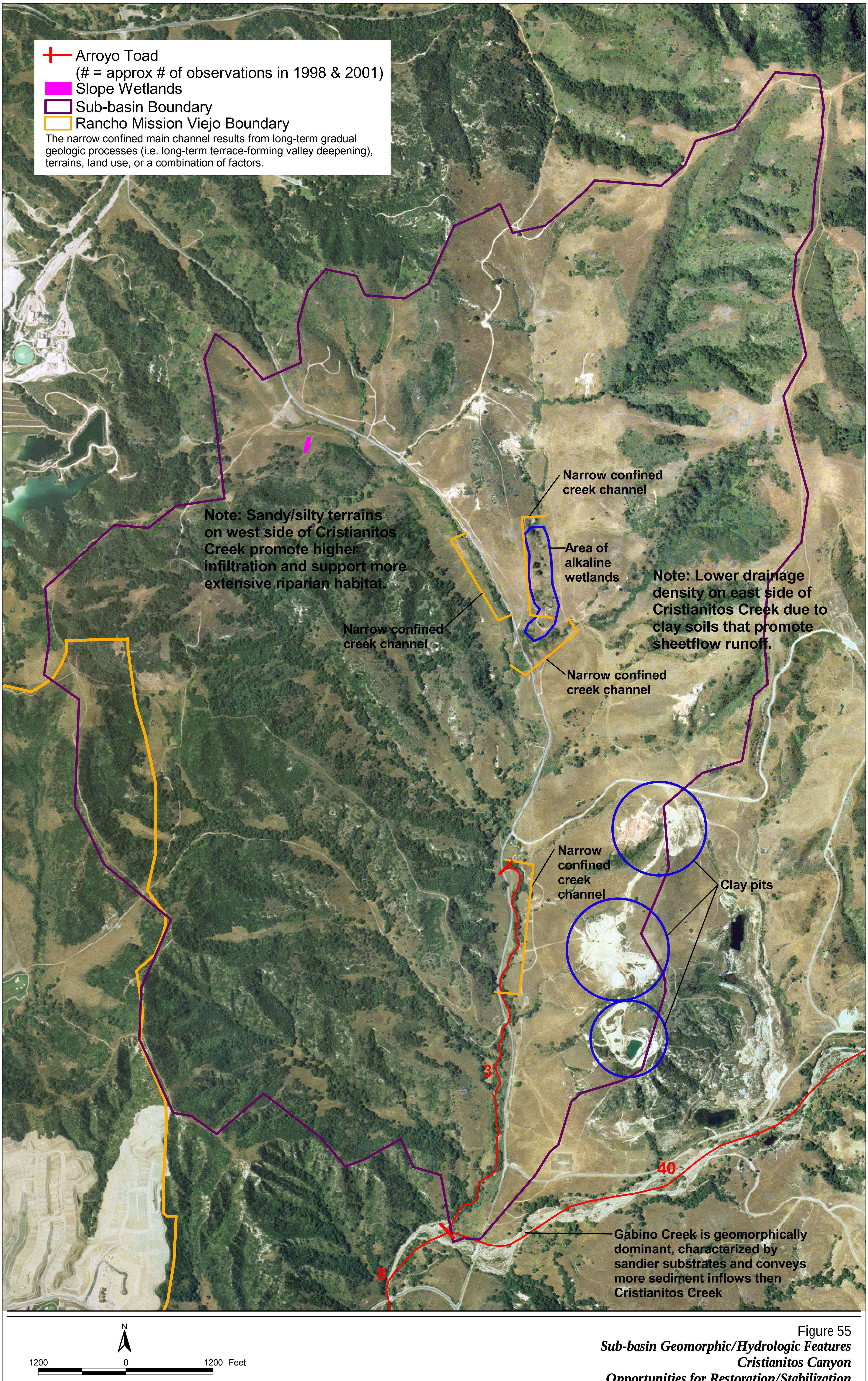


Figure 53
Sub-basin Geomorphic/ Hydrologic Features
Cristianitos Canyon Sub-Basin
Sediment Yield



Source: ACOE and PWA 2000.

Figure 54
Sub-Basin Geomorphic / Hydrologic Features Runoff and Infiltration Patterns for the Cristianitos Canyon Sub-basin



Source: Eagle Aerial Imaging 2001 and PCR 2002.

Figure 55
Sub-basin Geomorphic/Hydrologic Features
Cristianitos Canyon
Opportunities for Restoration/Stabilization

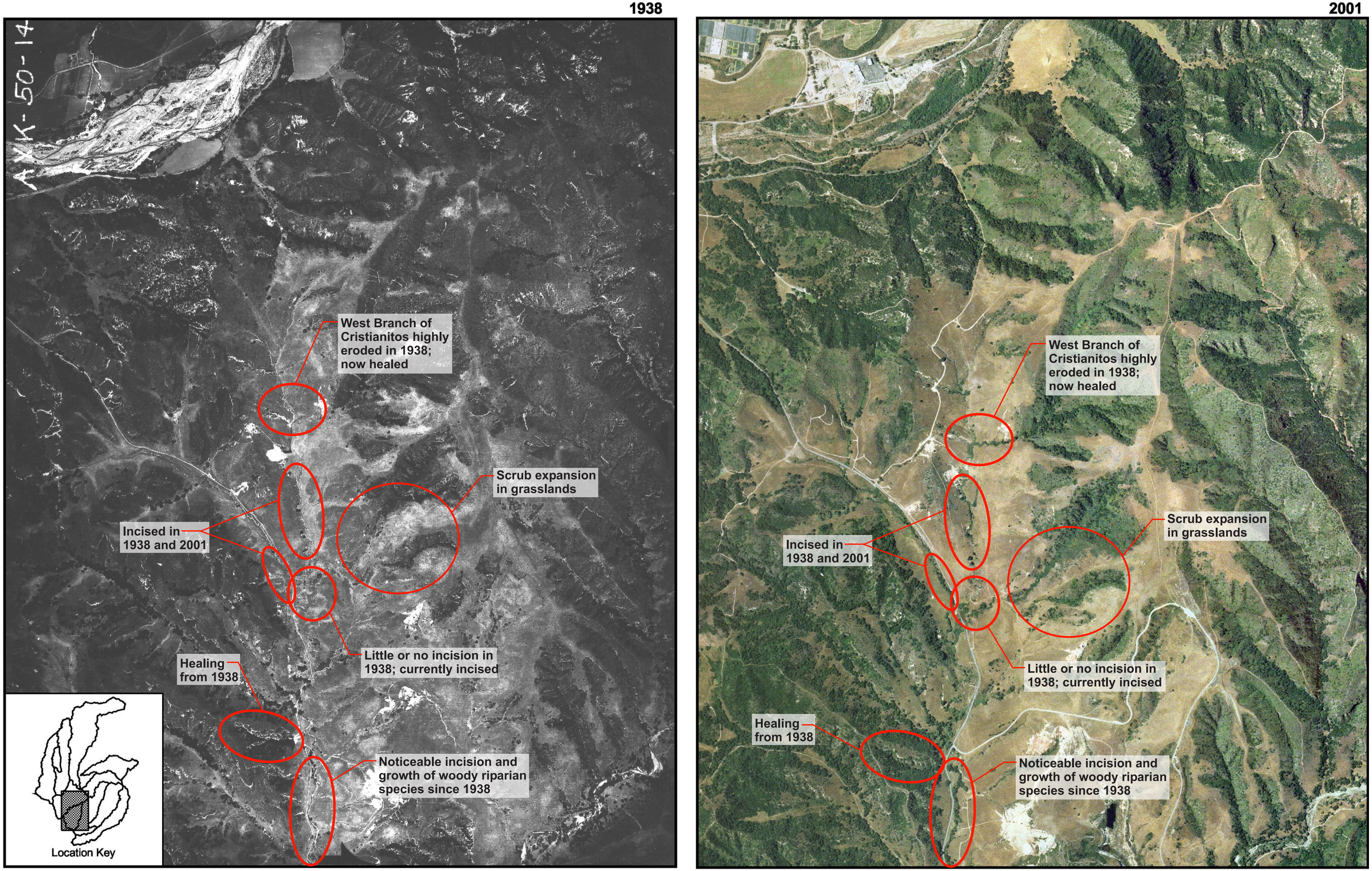


Figure 56
Upper Cristianitos
1938 and 2001 Aerial Photographs

10

ii) Gabino and Blind Sub-basin

WES General Assessment And Conclusions

Gabino Canyon

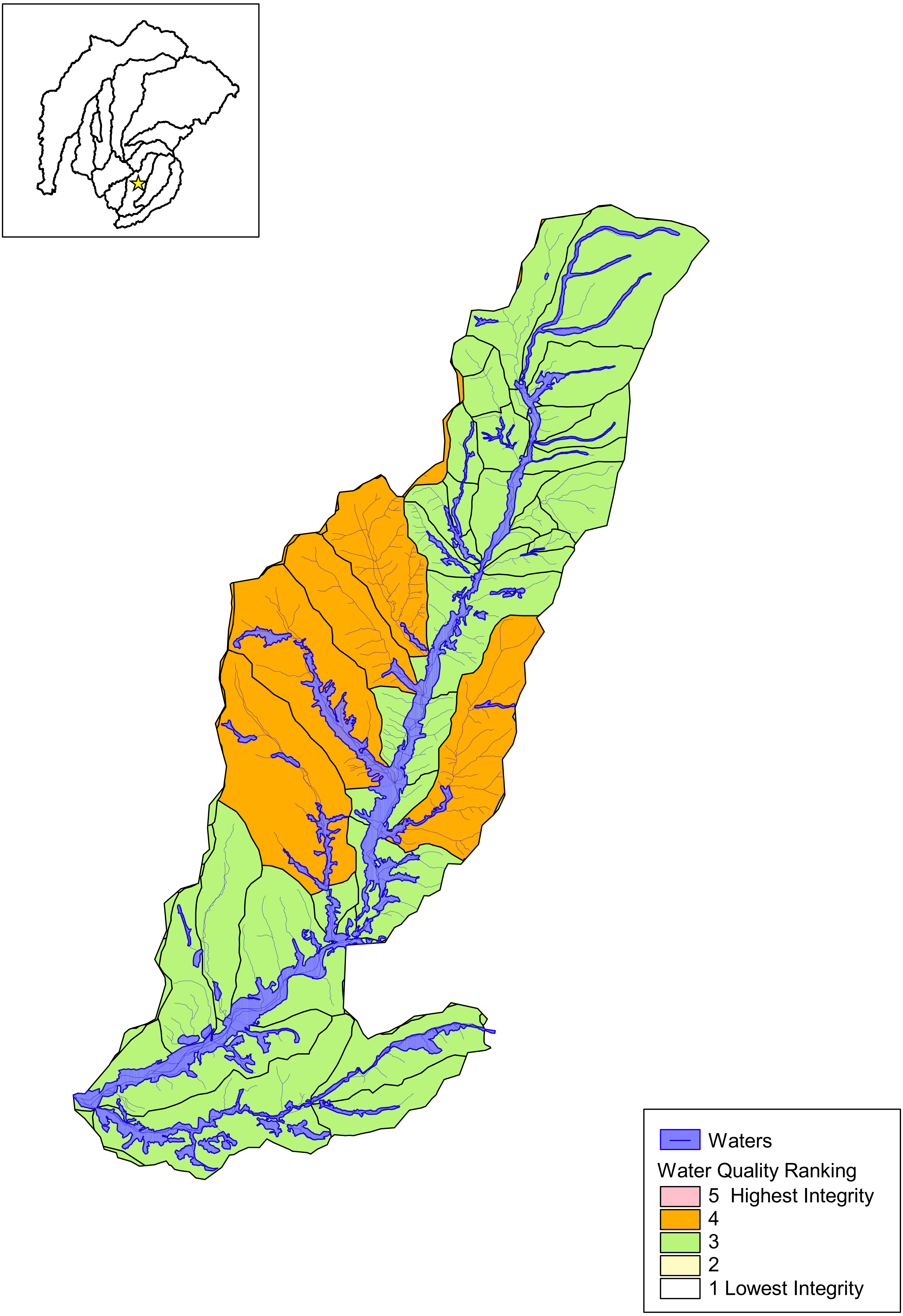
- Integrity of the upper watershed is slightly lower than that of the lower watershed.
- Overall Hydrologic Integrity is high. Overall Water Quality integrity is moderate.
- Overall, Habitat Integrity is moderate to high.
- Hydrologic regime relatively intact, no channelization, or major diversions.
- Generally poor interaction between the channel and the floodplain.
- Road adjacent to the creek in the middle and upper reaches represents an altered buffer condition and results in slightly decreased habitat integrity.
- Periodic breaks in the riparian corridor associated with road crossings.
- Altered sediment regime, especially in the upper watershed.
- Upland land use poses a risk of nutrient, pesticide, and sediment loadings to the creek, primarily in the upper portions of the sub-basin.

Blind Canyon

- Overall Hydrologic Integrity is high.
- Overall Water Quality Integrity is very high.
- Overall Habitat Integrity is moderate.
- Highest Overall Integrity of any sub-basin in San Mateo watershed (may be partially due to the small confined area compared to other sub-basins).
- Hydrologic regime relatively intact.
- Very poor interaction between the channel and the floodplain throughout the length of the creek.
- Reconnection of channel and floodplain represents a significant restoration opportunity.

- Upland land use poses a risk of nutrient, pesticide, and sediment loadings to the creek.

Figure 57
Gabino and Blind Sub-basins



Note: Data from WES Functional Evalution.

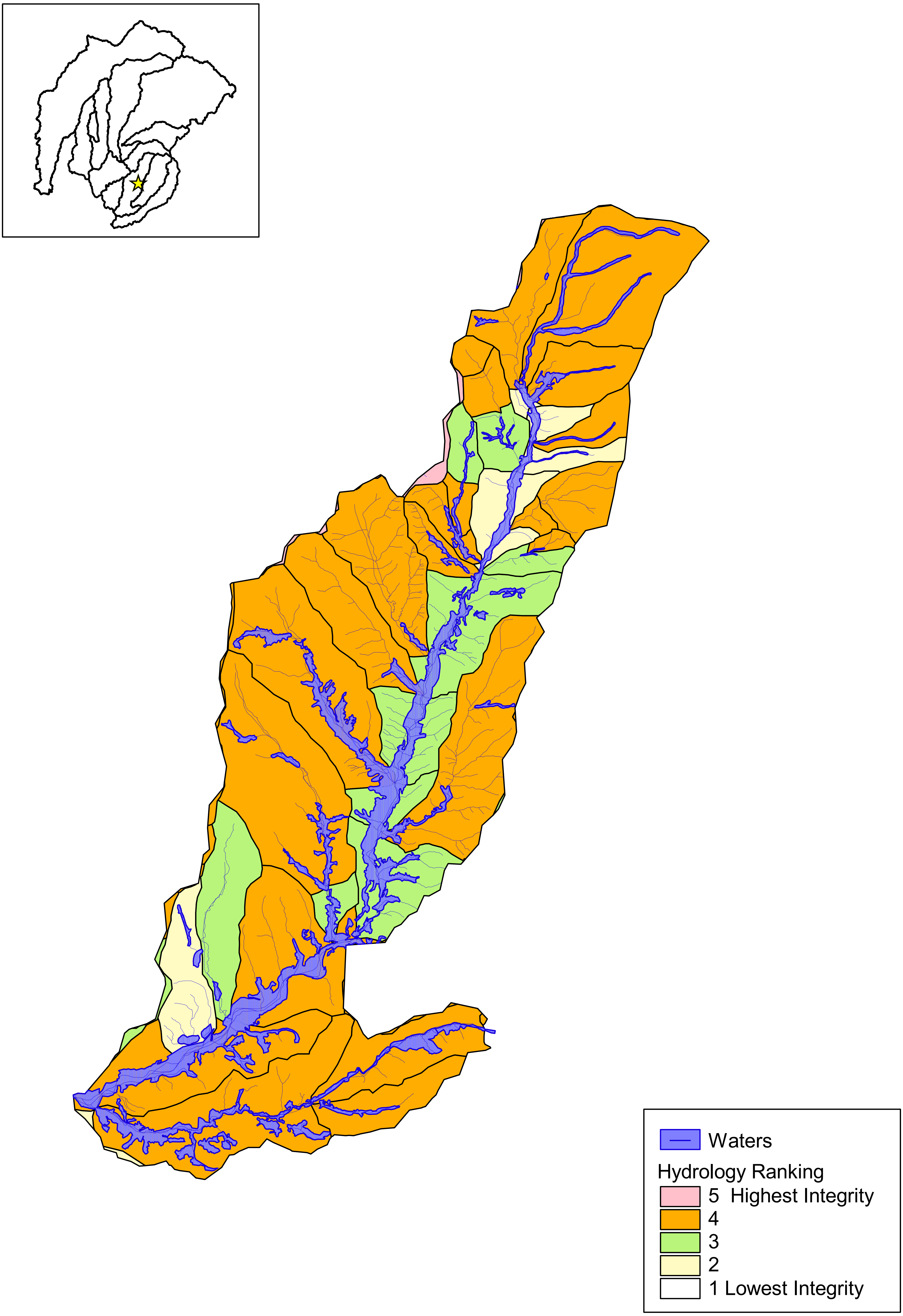
N

0.4 0 0.4 0.8 Miles

Source: ACOE 2000 and PCR 2002.

Figure 58

Water Quality Integrity Ranking
Gabino and Blind Canyon Sub-basins



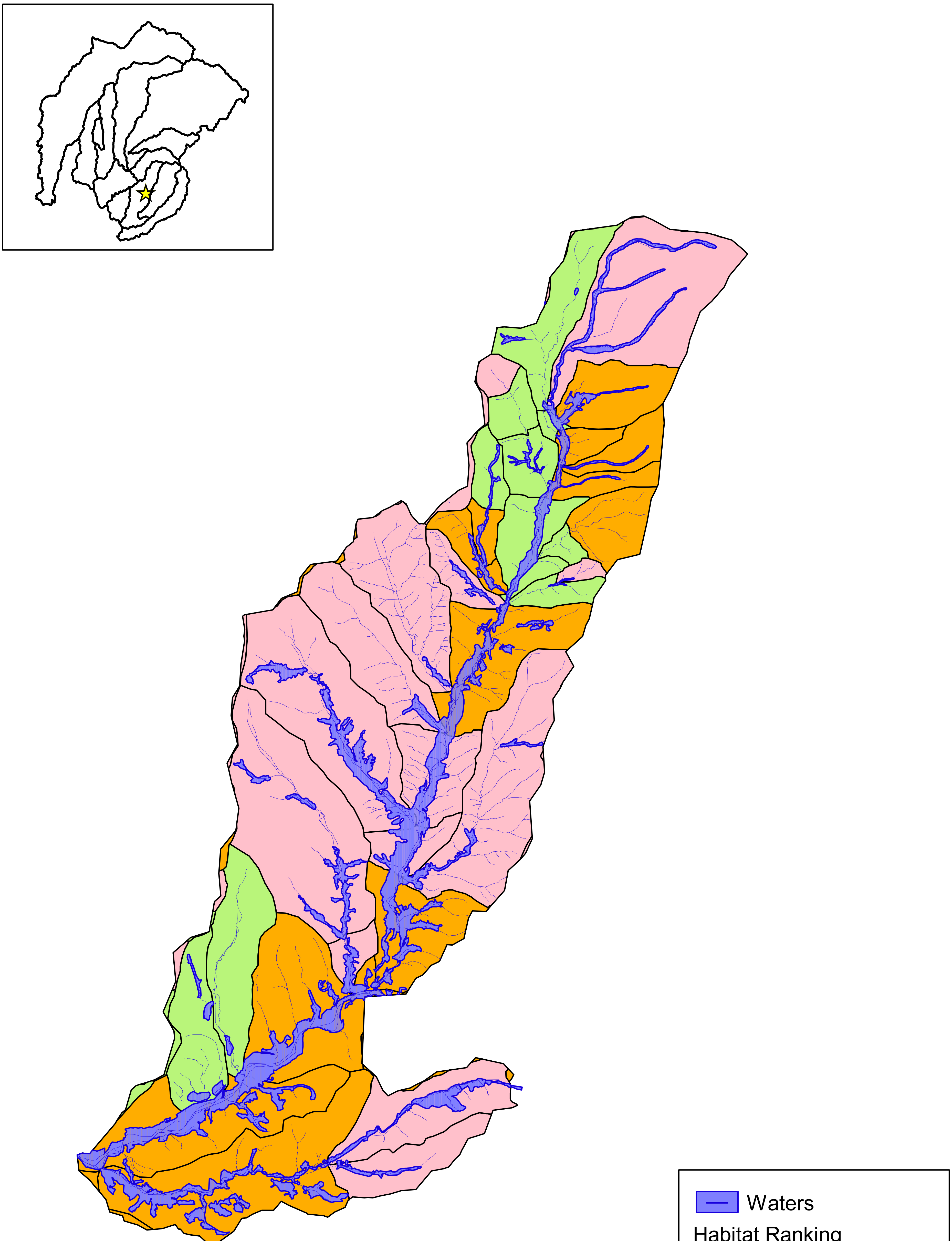
Note: Data from WES Functional Evalution.

N

0.4 0 0.4 0.8 Miles

Source: ACOE 2000 and PCR 2002.

Figure 59
Hydrology Integrity Ranking
Gabino and Blind Canyon Sub-basins



Note: Data from WES Functional Evalution.

N

0.4 0 0.4 0.8 Miles

Source: ACOE 2000 and PCR 2002.

Figure 60
Habitat Integrity Ranking
Gabino and Blind Canyon Sub-basins

Planning Considerations - Significant Terrains and Hydrologic Features

- Gabino and Talega Canyons are the largest sub-basins in the western San Mateo watershed.

- Gabino Canyon has the highest predicted absolute peak flow and runoff volume of the sub-basins studied in the western San Mateo watershed. This is due to its size, position high in the watershed, steep topography, and the narrow geologically confined nature of the middle and lower reaches of the sub-basin. Simulated hydrographs indicate a somewhat "flashy" runoff response in this sub-basin.

- Gabino Canyon has the highest predicted sediment yield and transport rate of any sub-basin analyzed in the western San Mateo sub-watersheds.

- Fine sediment generation in the upper sub-basin may exceed natural conditions due to extensive gully formation in the headwater areas.

- Terrains in the middle reaches are very steep, with high drainage densities and have very limited stormwater infiltration capacity.

- Sediments produced from the middle portion of the sub-basin are primarily coarse sediments, including sands and cobbles, which are mobilized and transported during extreme episodic events. These sediments are probably very important to downstream channel structure and provide geomorphologic elements of habitats for sensitive species found in the middle and lower reaches of Gabino Creek and further downstream.

- In wet years, the creek flows through the late spring and seasonal pools persist in some locations (probably associated with bedrock outcrops). However, these pools seldom if ever persist through the summer.

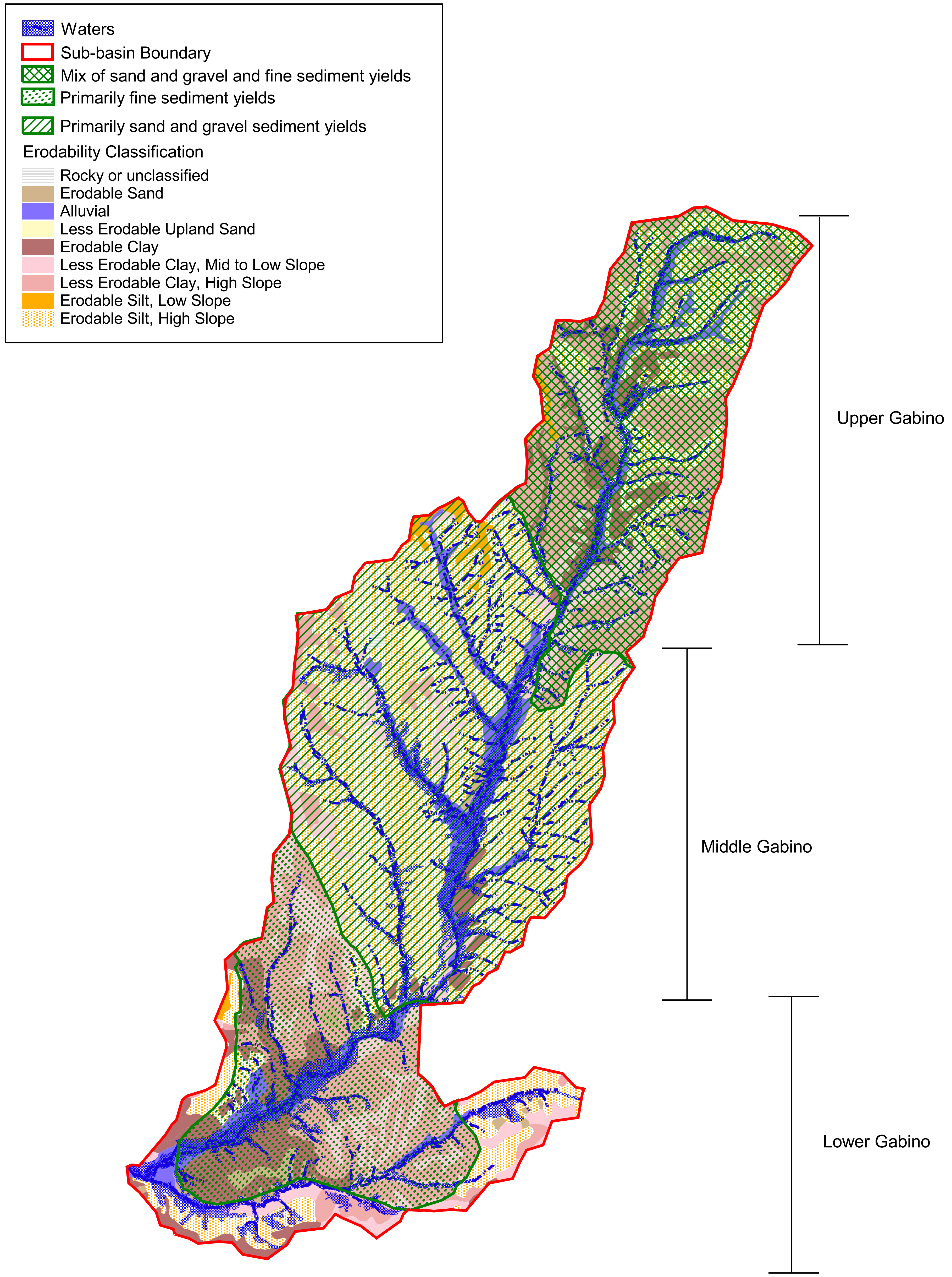
- Groundwater does not appear to be a significant element of the Creek's hydrologic system, with the possible exception of the lower reaches (i.e., below the confluence with La Paz). It appears that the alluvium in this sub-basin is recharged during winter runoff events and once the limited aquifer storage has been seasonally depleted, little ongoing replenishment occurs until the next event.

- Along the lower reaches of the Creek, terrains to the north include clayey soils and a major unnamed side canyon that has been extensively modified by clay mining activities.

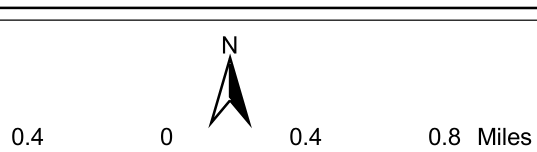
- The area south of Blind Canyon is comprised of a mesa top that has been grazed and is characterized by high gradient, coarse-bedded channel, and sycamore and oak riparian forest. The slopes of the canyon contain other significant habitat including coast live oak.

Planning Recommendations

- Limit new impervious surfaces in the headwater area to locations that will not adversely impact runoff patterns.
- Protect the headwaters through restoration of existing gullies using a combination of slope stabilization, grazing management, and native grasslands and/or scrub restoration. To the extent feasible, restore native grasses to reduce sediment generation and promote infiltration of stormwater.
- Modify grazing management in the upper portion of the sub-basin to support restoration and vegetation management in the headwater areas.
- Minimize impacts to the steep side canyons in the middle portion of the sub-basin by limiting new impervious surfaces.
- To the extent feasible, focus development in the clayey soils and terrains in the lower portions of the sub-basin, where it could serve to reduce the generation of fine sediments and associated turbidity.
- To the extent feasible, utilize the side canyon currently degraded by past mining activities for natural water quality treatment systems.
- In the lower reach of the Creek, protect significant riparian habitats along the south side of the Creek and on proximate side canyon slopes. Limit development and other uses in Blind Canyon to the grazed areas on the mesa and away from the major oak woodlands in Blind Canyon. Direct to and treat stormwater runoff in areas that will not contribute to appreciable increases in water delivery/flow to the oak woodlands in the lower portion of the sub-basin.
- Protect the integrity of arroyo toad populations in lower Gabino Creek by maintaining hydrologic and sediment delivery processes, including maintaining the flow characteristics of episodic events in the sub-basin. Utilize natural water quality treatment systems to manage and treat runoff from any new land uses in areas adjacent to the lower creek.

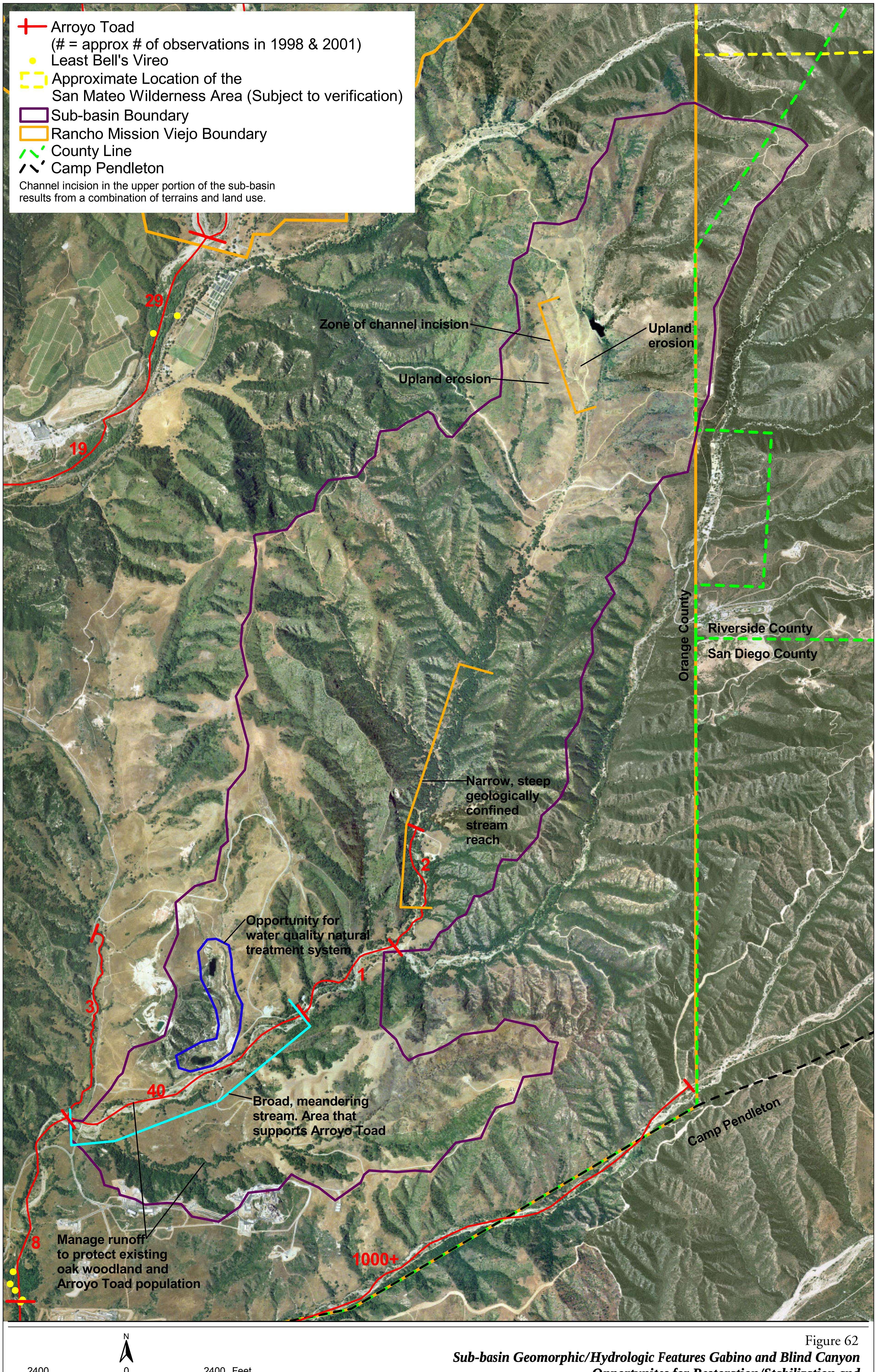


(Note: Erosion in middle and upper Gabino Canyon may be contributing to high sediment yield from this sub-basin.)



Source: ACOE, PWA 2000 and PCR 2002.

Figure 61
Sub-basin Geomorphic/Hydrologic Features
Gabino and Blind Canyon Sub-Basins
Sediment Yield



Source: Eagle Aerial Imaging 2001 and PCR 2002.

Figure 62

Sub-basin Geomorphic/Hydrologic Features Gabino and Blind Canyon Opportunites for Restoration/Stabilization and Water Quality Natural Treatment Systems

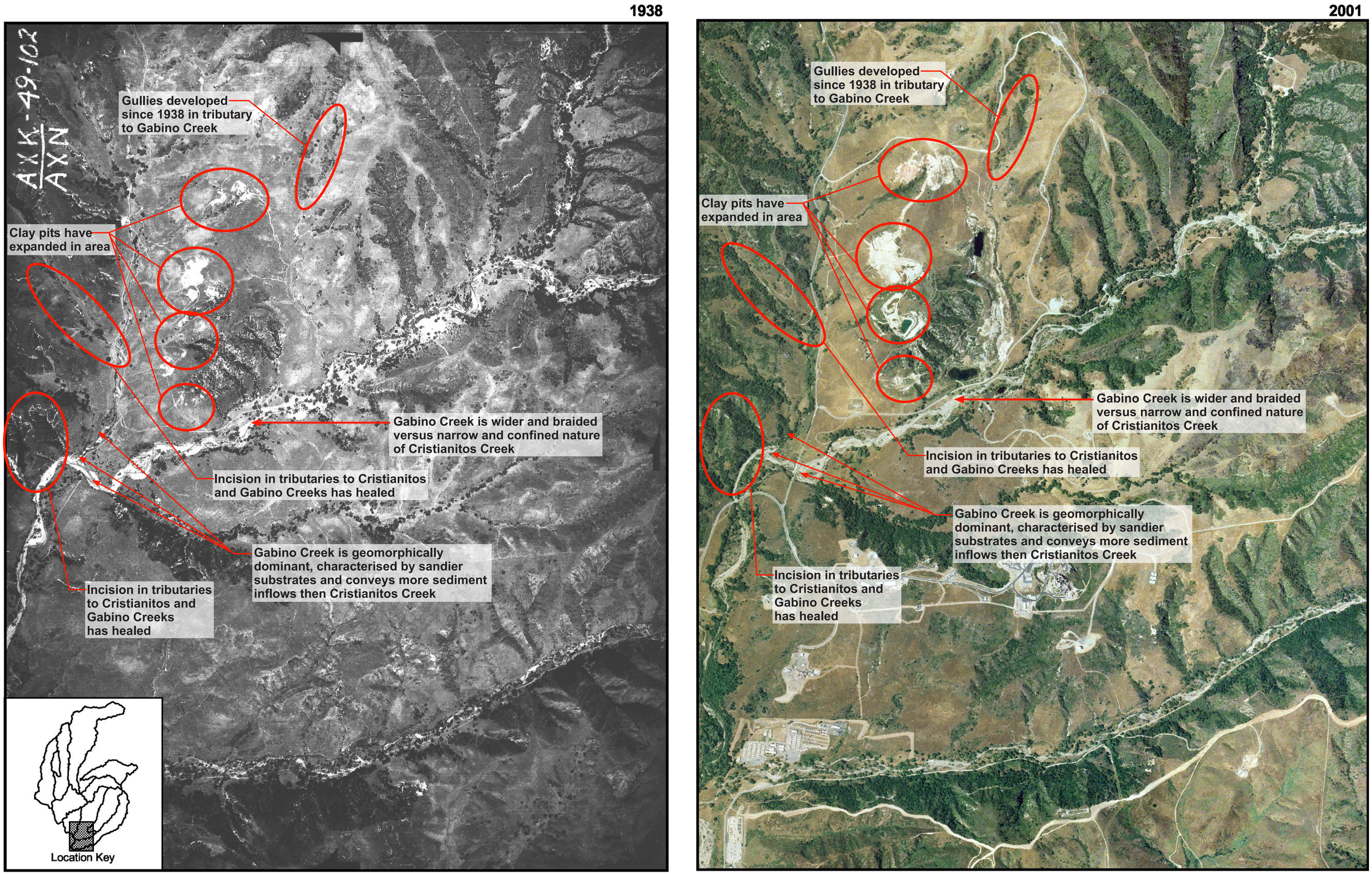


Figure 63
Gabino, Talega and Lower Cristianitos
1938 and 2001 Aerial Photographs

iii) La Paz Sub-basin

WES General Assessment and Conclusions

- Overall Hydrology and Habitat Integrity is high.
- Overall Water Quality Integrity is moderate.
- Hydrologic regime relatively intact, no channelization or major diversions.
- Mainstem creek has poor interaction between channel and the floodplain.
- Upland land use poses a risk of nutrient, pesticide, and sediment loadings to the creek; however, to a lesser extent than in Gabino Canyon.
- Lower portion of La Paz Canyon has areas with an altered or reduced buffer.

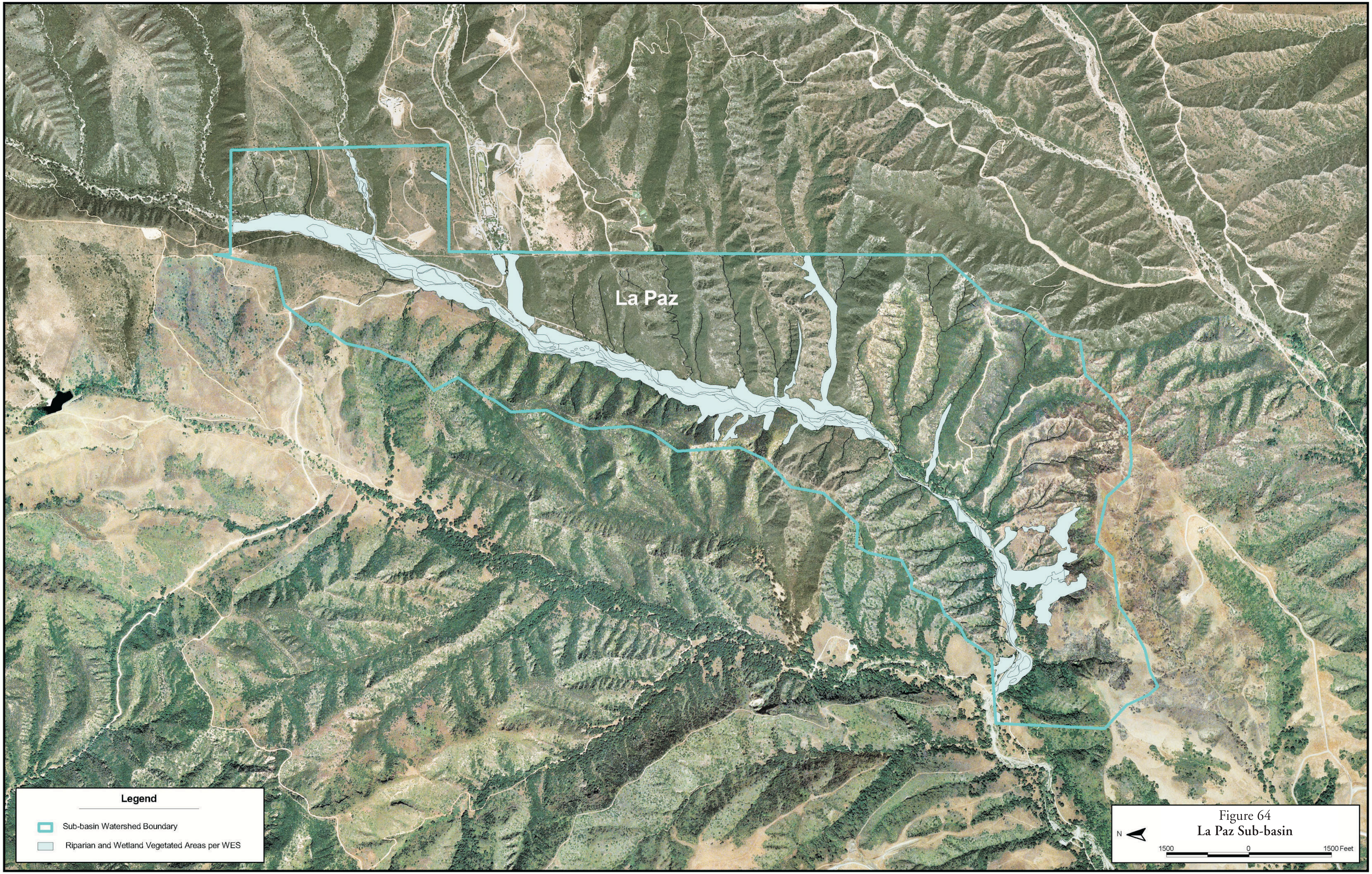
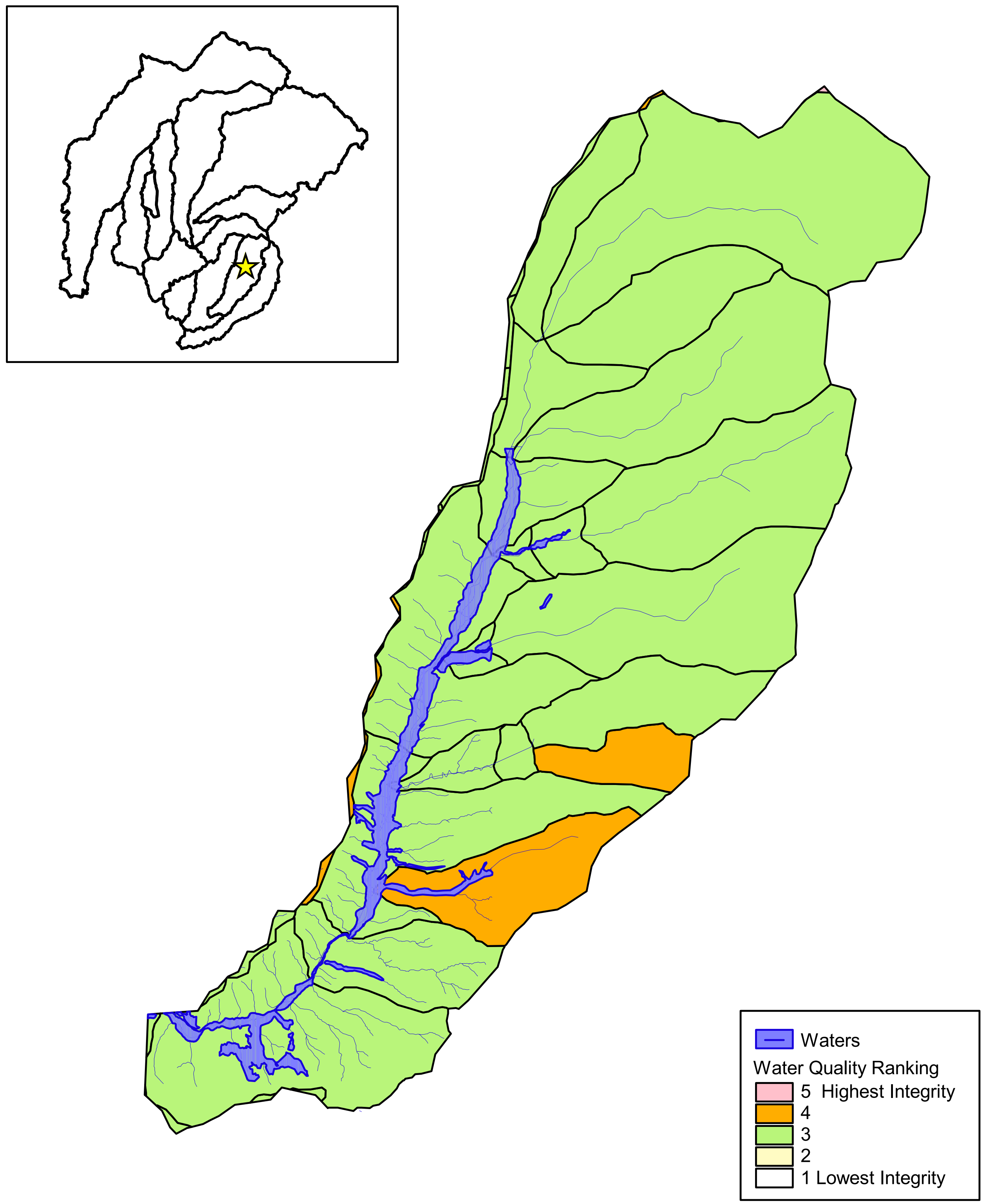


Figure 64
La Paz Sub-basin



Note: Data from WES Functional Evalution.

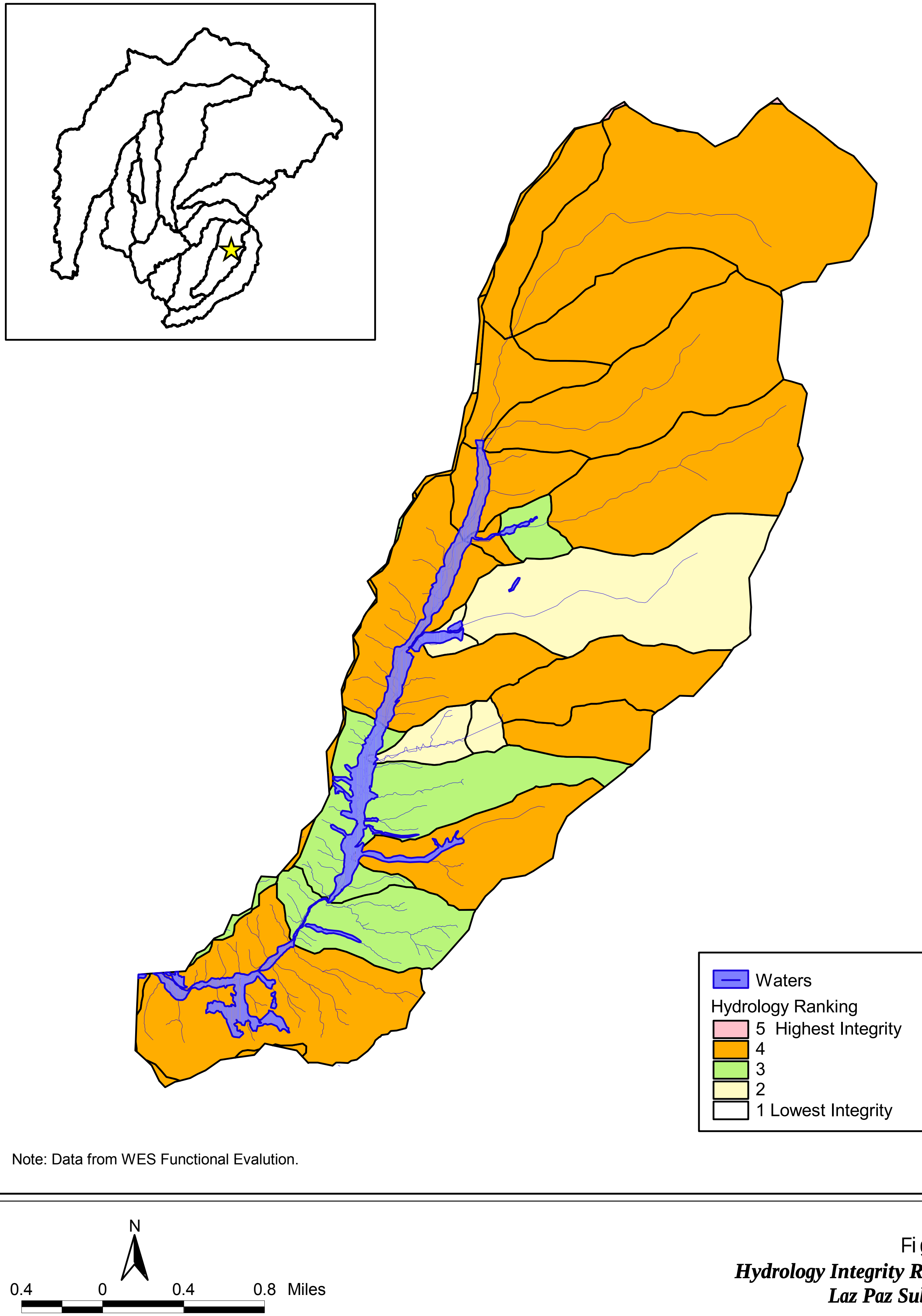
N

0.4 0 0.4 0.8 Miles

Source: ACOE 2000 and PCR 2002.

Figure 65

Water Quality Integrity Ranking
Laz Paz Sub-basin



Note: Data from WES Functional Evalution.

Source: ACOE 2000 and PCR 2002.

Figure 66

Hydrology Integrity Ranking
Laz Paz Sub-basin

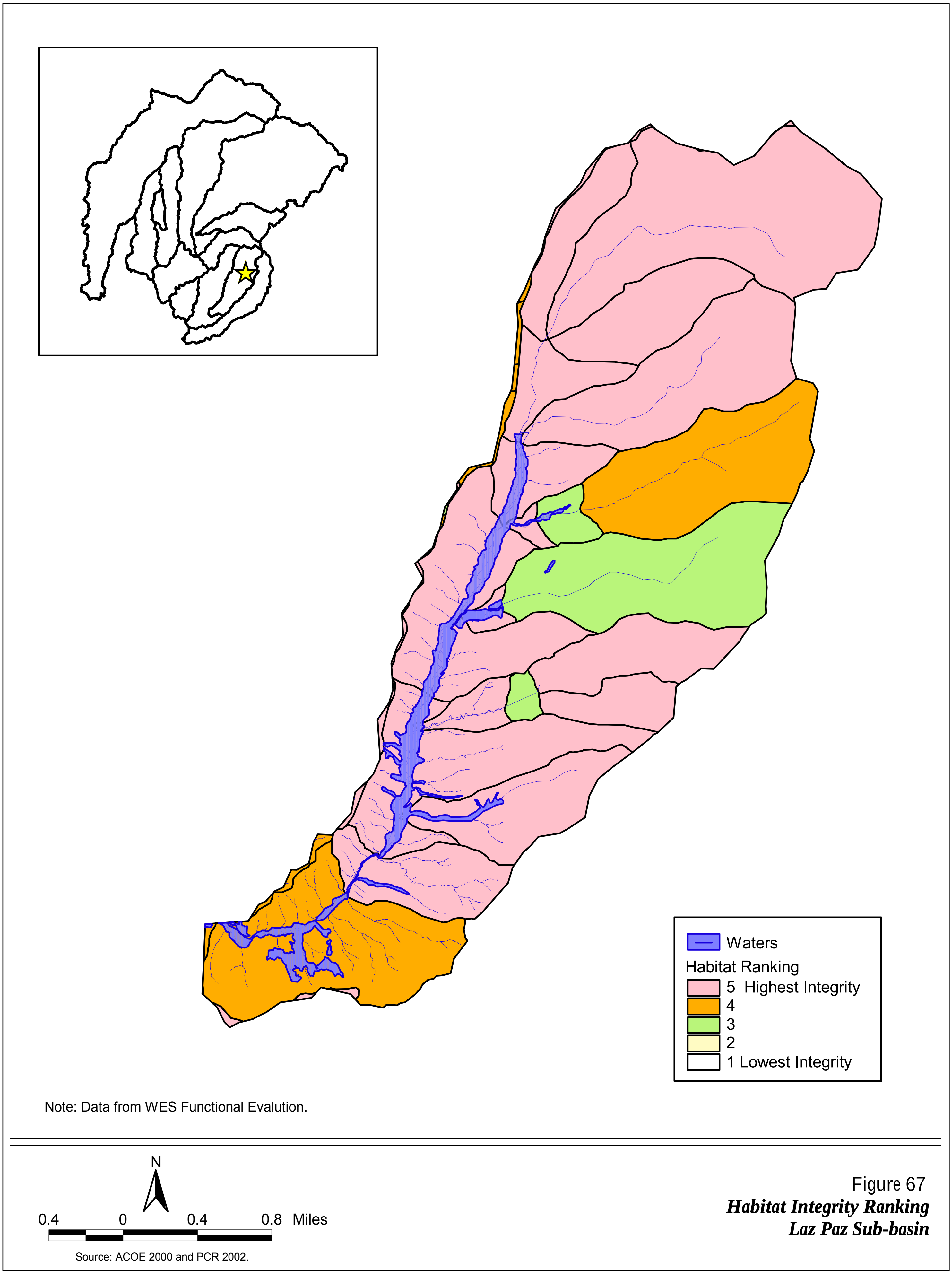


Figure 67

Habitat Integrity Ranking
Laz Paz Sub-basin

Planning Considerations – Significant Terrains and Hydrologic Features

- The majority of the La Paz Sub-basin (including all of its headwaters) is located outside the SAMP/MSAA and NCCP/HCP study areas.

- Runoff per unit area is higher for the La Paz Sub-basin than for Gabino and Talega due to the altitude and steepness of the headwaters, higher rainfall in the upper watershed due to orographic effects, and high proportion of crystalline terrains and Class D soils.

- The headwaters of the La Paz Sub-basin are in the Trabuco formation, which yields more water than other sub-basins in the western San Mateo watershed (i.e., within the SAMP/MSAA study area).

- Predicted sediment yields and transport rates for La Paz Canyon are the lowest of any of the sub-basins analyzed in the San Mateo watershed. The low yields may be partially due to the relatively large proportion of very coarse substrates (i.e., large cobbles and boulders) produced from La Paz Canyon. These coarse substrates are likely mobilized very infrequently during large-scale episodic events, at which time they play a significant role in reshaping the geomorphology of the lower portions of the watershed.

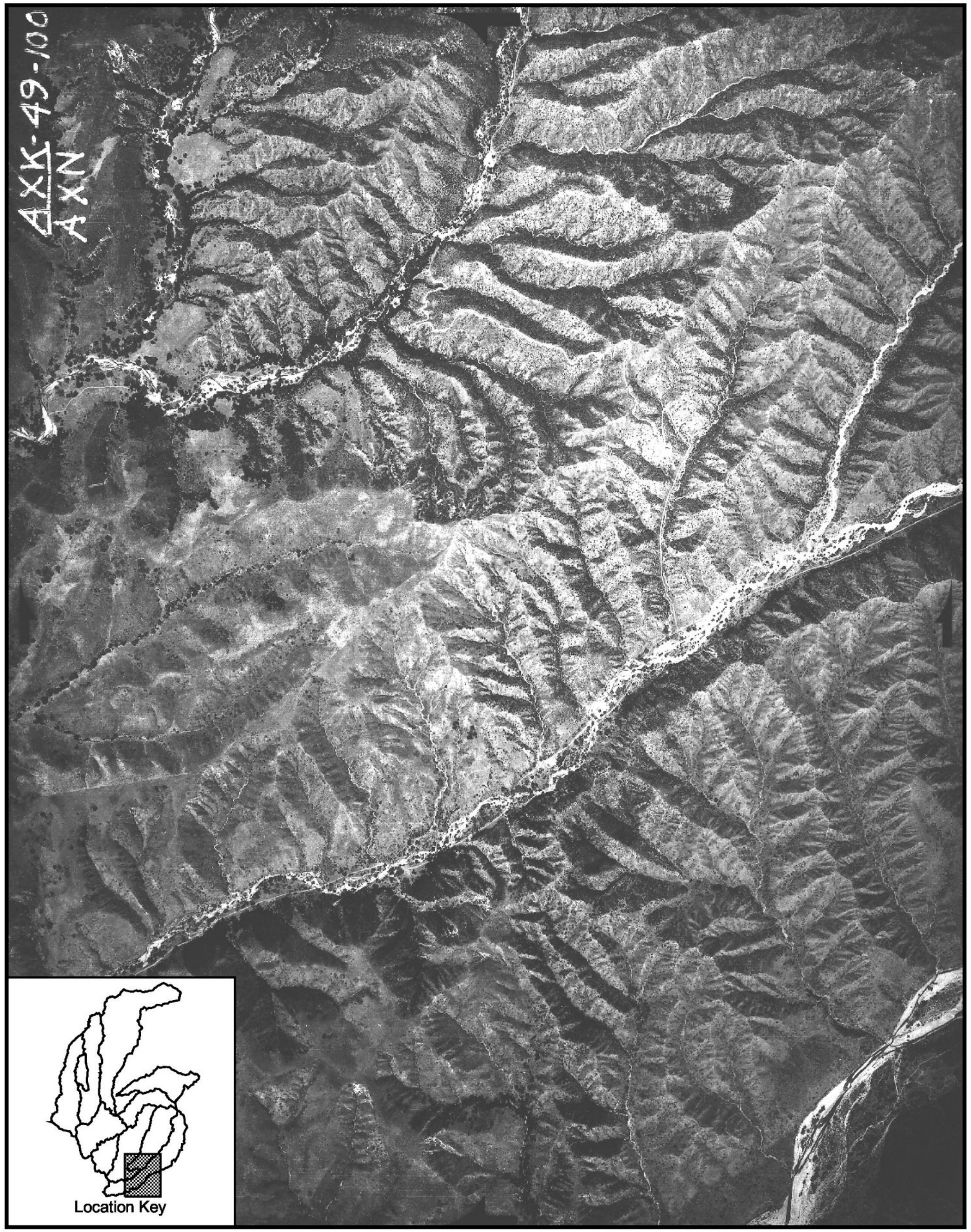
- The riparian zones within the La Paz Sub-basin are confined by the geology of the valley, but contain high topographic complexity (including bars and ponds that are inundated late into the spring), an abundance of coarse and fine woody debris, leaf litter, and a mosaic of understory plant communities. Portions of the streams that convey seasonal high velocity flows also retain water for extended periods of time in shallow depressions within the active channel.

Planning Recommendations

- Development should be limited in extent in order to protect the generation and transport of coarse sediment to downstream areas.

- Development should be set back from riparian habitat within the relatively narrow and geologically confined riparian zone.

1938



2001

Figure 68
La Paz
1938 and 2001 Aerial Photographs

iv) Talega Sub-basin

WES General Assessment and Conclusions

No WES general assessment and conclusions are available at this time for the Talega Sub-basin.

Planning Considerations - Significant Terrains and Hydrologic Features

- Talega Canyon straddles the boundary of RMV and Camp Pendleton, with at least a third of the upper watershed located outside the SAMP/MSAA and NCCP study areas in the San Mateo Wilderness Area. The existing TRW facilities are on the ridge above Talega Canyon, with runoff draining both to Talega Canyon and to Blind Canyon/Gabino Canyon.

- Talega Canyon has the highest proportion of poorer infiltrating Type D soils of any of the other sub-basins analyzed in the San Mateo watershed and yield relatively high runoff volumes. Although the simulated hydrographs for Talega Creek have a pronounced peak, they are relatively broad. The broader peaking is likely due to the elongated geometry of the sub-basin, which tends to attenuate flood movement as it travels through the sub-basin. Thus, runoff volumes are high but peak discharge rates are attenuated as stormwater travels downstream through the sub-basin.

- The headwaters of Talega Creek (which are outside the SAMP/MSAA and NCCP study areas) are in weathered granitic rocks that sustain a substantial density of springs. These springs help support a more dense riparian corridor in the upper portion of the sub-basin, and may contribute to late season moisture in Talega Creek.

- Talega Creek supports one of the two largest population of arroyo toads in the planning area. The creek substrate is rock/cobble with sandbars forming in depositional areas. Riparian habitat consists of dense stands of mature, structurally diverse coast live oak and southern sycamore riparian woodlands. Central reaches of the creek support mule fat scrub and open sand bar habitat. Riparian zones contain high topographic complexity, an abundance of coarse and woody debris, leaf litter and a mosaic of understory plant communities. The creek contains shallow pools that retain water into the late spring and early summer, a water supply likely to be of significance for arroyo toad breeding habitat, but does not appear to be sufficient to sustain steelhead.

Planning Recommendations

- To the extent feasible, major stormwater flows from development areas should emulate current runoff patterns. Runoff during the dry season and high frequency/low magnitude storms (generally 1–2 year storm events) should be routed through natural water quality treatment systems and, where feasible, encouraged to flow generally away from arroyo toad habitat in Talega Canyon and toward Blind Canyon.

- Development should focus on the ridge tops to avoid the canyon bottoms and preserve the steeper slopes. To the extent practical, development should generally be in the area of the existing TRW facilities and adjacent ridges to the east/northeast.

- The timing of peak flows should emulate the timing of flows under existing conditions.

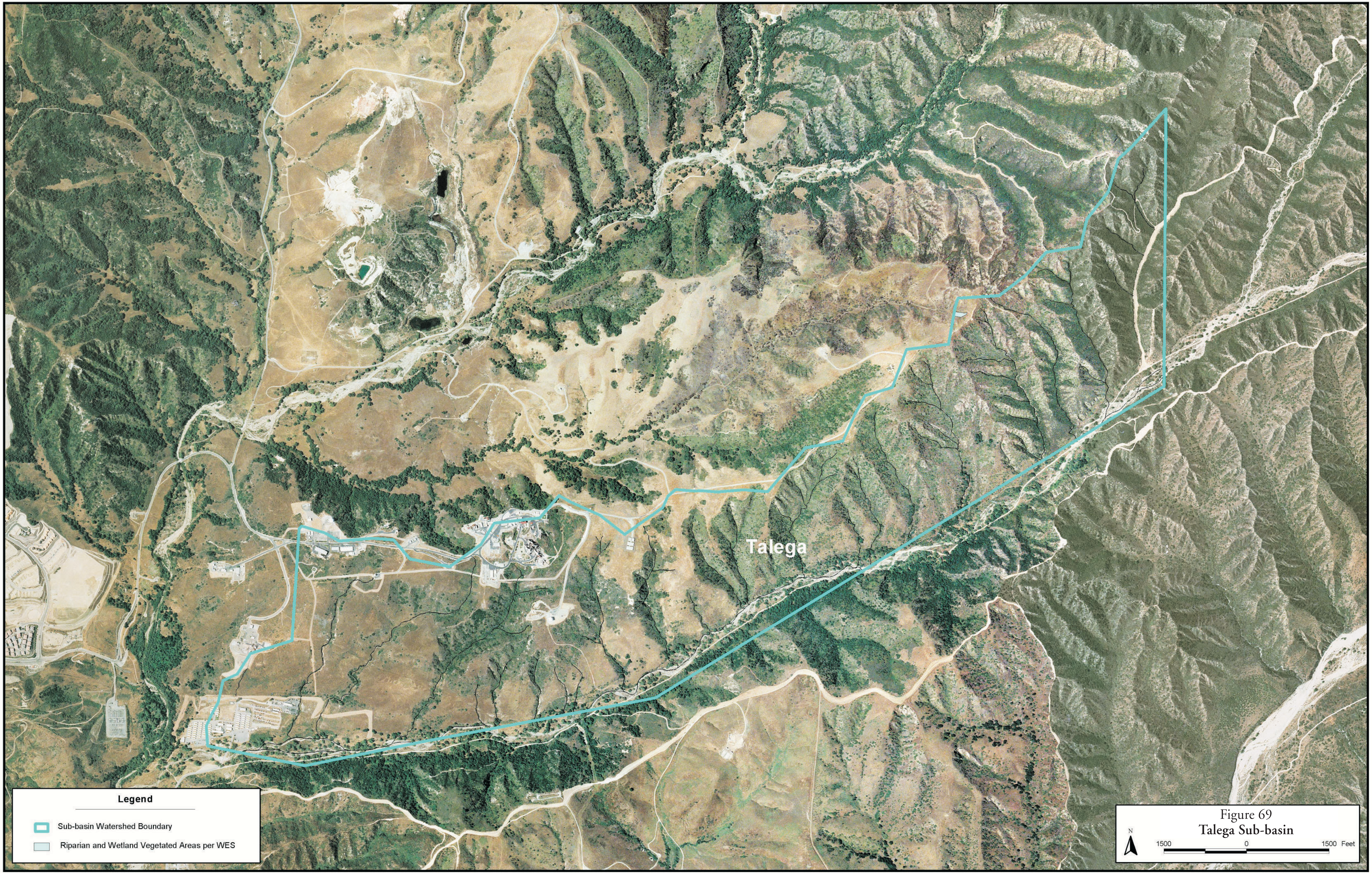


Figure 69
Talega Sub-basin

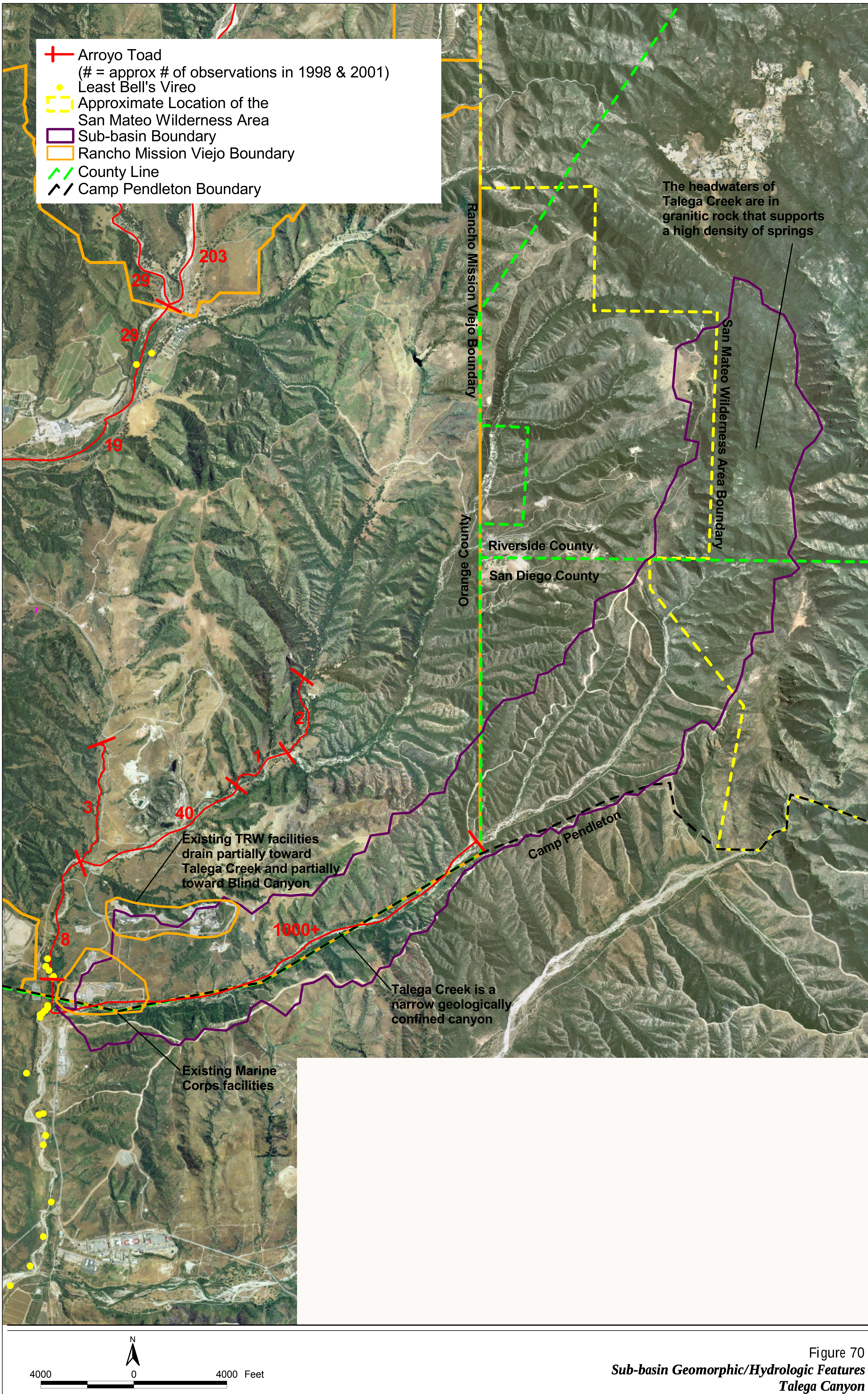
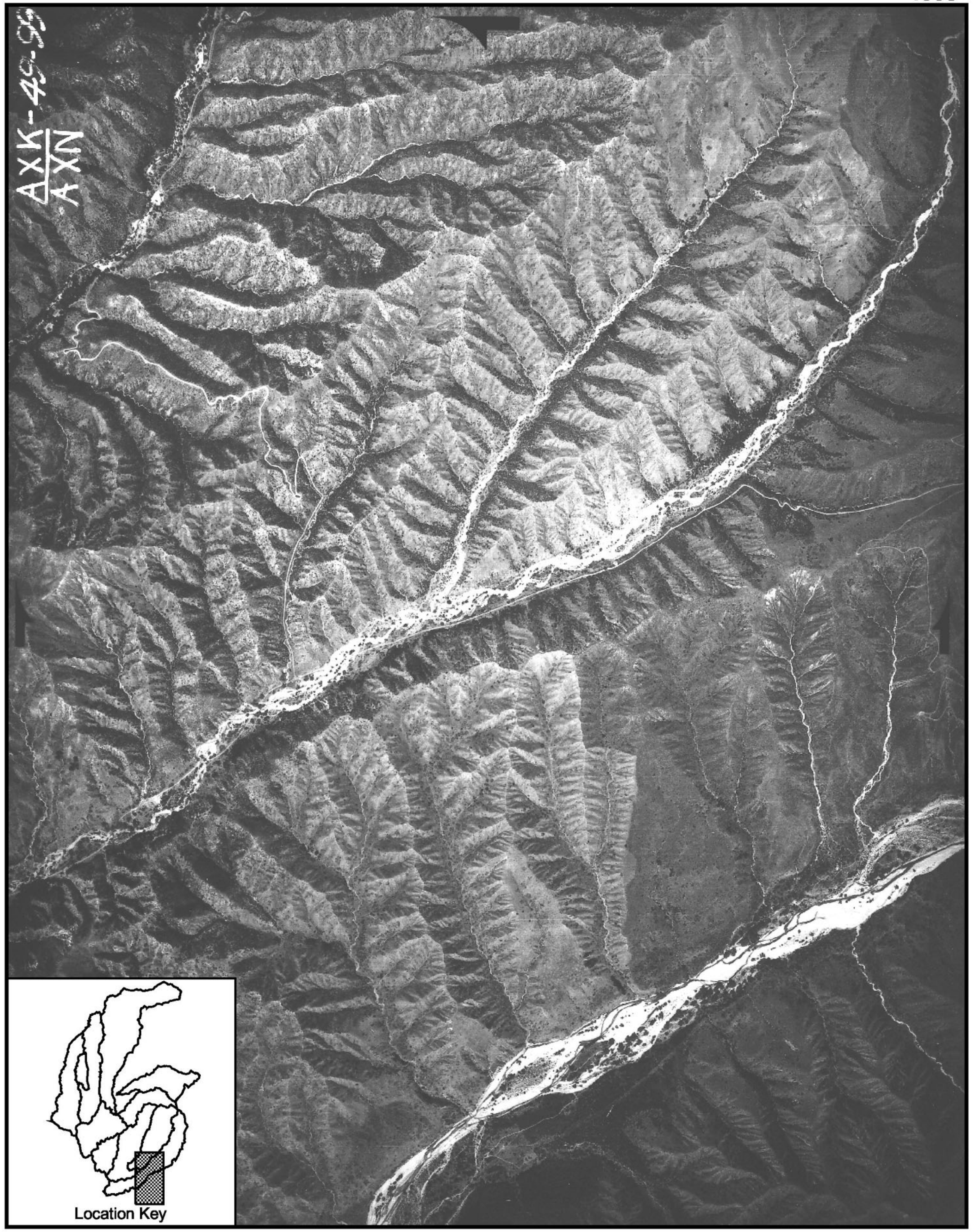


Figure 70

Sub-basin Geomorphic/Hydrologic Features

Talega Canyon

1938

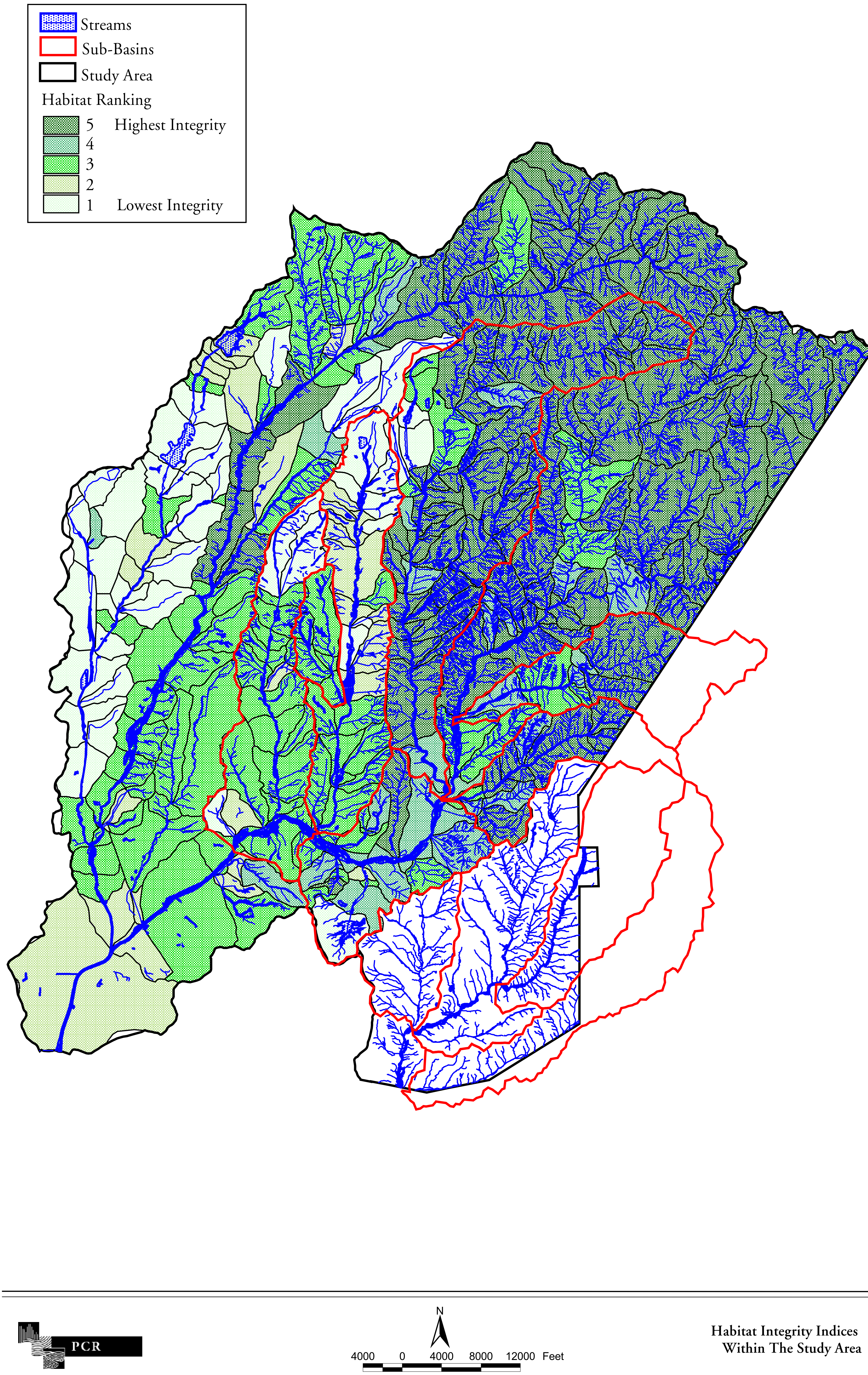


2001

Figure 71
Talega
1938 and 2001 Aerial Photographs

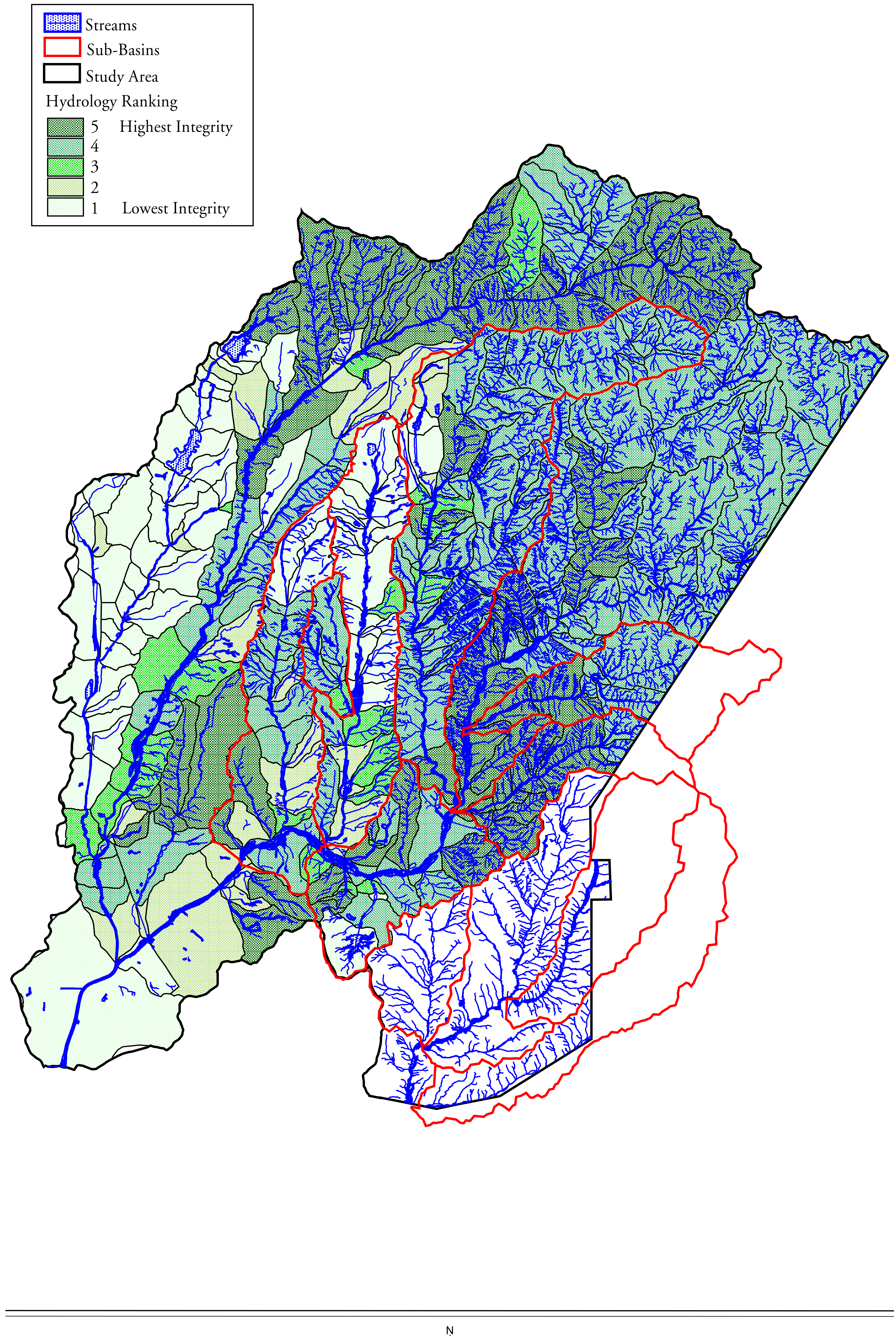
Appendix A

APPENDIX A
ACOE INTEGRITY INDICES FOR SAN JUAN AND SAN MATEO CREEK WATERSHEDS

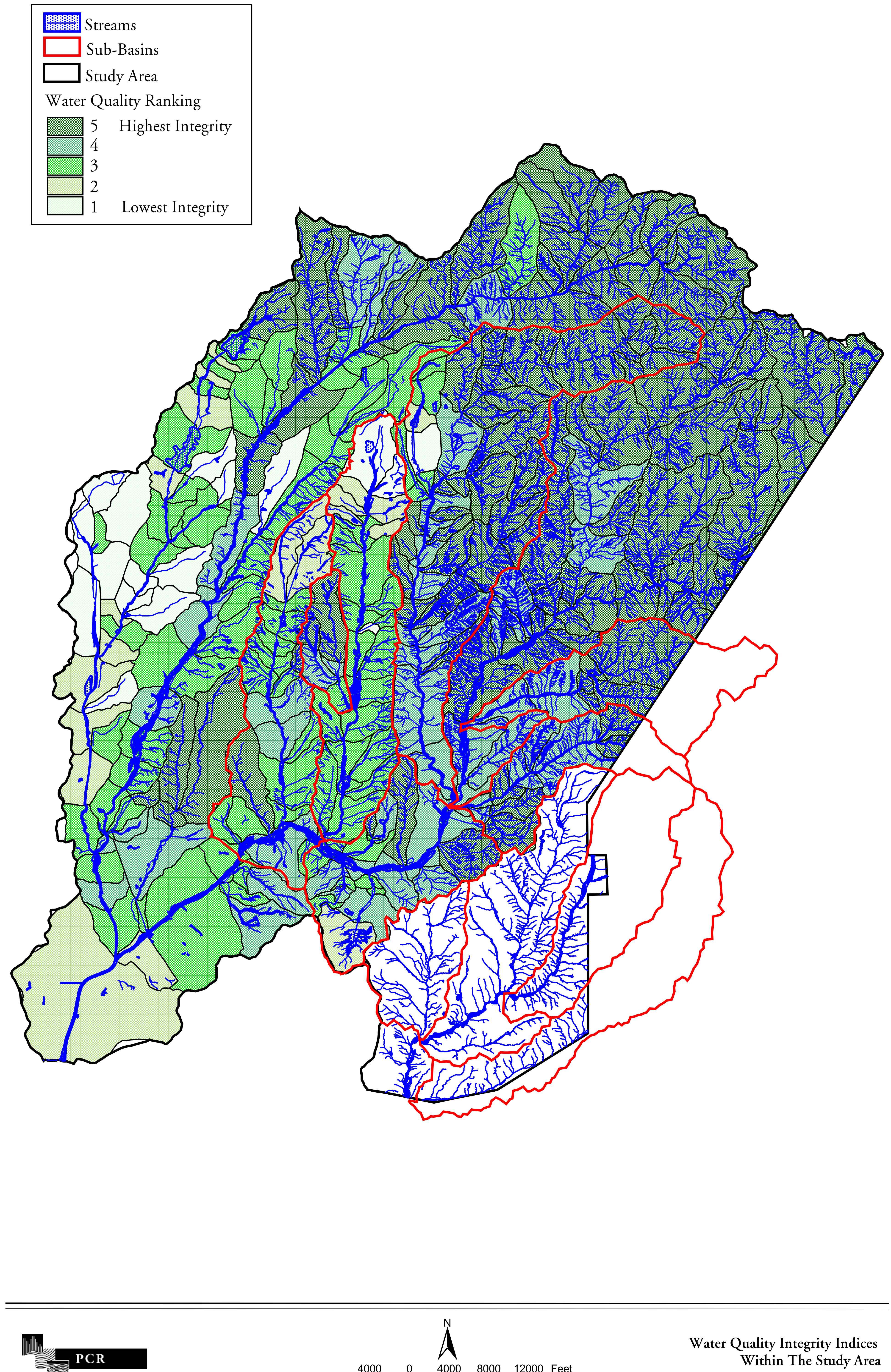


PCR

Habitat Integrity Indices Within The Study Area



Hydrology Integrity Indices
Within The Study Area



Water Quality Integrity Indices
Within The Study Area