STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 92-04

CERTIFICATION OF U.S. FOREST SERVICE BEST MANAGEMENT PRACTICES FOR WATER RESOURCE PROTECTION ON LOCATABLE MINERAL OPERATIONS (PRACTICE 3-1) AND FOR CUMULATIVE OFF-SITE WATERSHED EFFECTS ANALYSIS (PRACTICE 7-8)

WHEREAS:

1. By Resolution 81-13, the State Water Resources Control Board (SWRCB) certified a Water Quality Management plan (WQM Plan) titled "Water Quality Management for National Forest System (NFS) Lands in California", entered into a Management Agency Agreement (MAA) with the U.S. Forest Service (USFS) for implementation of the WQM Plan, and designated USFS as water quality management agency for activities on NFS lands in California.

2. By Resolution 88-13, the SWRCB certified a WQM plan for timber operations on non-Federal lands, entered into an MAA with the California Department of Forestry and Fire Protection (CDF) and the Board of Forestry (BOF) for implementation of the WQM plan, and designated CDF and BOF as joint management agencies for timber operations on non-Federal lands.

3. The two MAAs provide for development and implementation of best management practices (BMPs) by each management agency for assessing cumulative watershed effects. In addition, the USFS MAA provides for development and implementation of a BMP for water resource protection on locatable mineral operations.

4. In carrying out its MAA commitments, USFS has developed and presented to the SWRCB two proposed BMPs: Practice 3-1, titled "Water Resource Protection for Locatable Mineral Operations" (Attachment 1) and Practice 7-8, titled "Cumulative Off-Site Watershed Effects Analysis" (Attachment 2). USFS has requested that these two practices be certified by the SWRCB as BMPs pursuant to Section 208 of the Federal Clean Water Act.

5. On July 11, 1989, the SWRCB held a hearing to receive comments on the acceptability of the two proposed BMPs.

6. These comments indicate that: (a) both proposed BMPs are currently acceptable for certification, and (b) further refinements should be sought in the procedures set forth in Practice 7-8 for assessing cumulative watershed effects in the way the practice is implemented and in the way the cumulative watershed effects assessment results are used in making land management decisions.

7. BOF is currently holding hearings on proposed Forest Practice Rules (Rules) for assessing cumulative watershed effects of timber operations on non-Federal lands. After being adopted these Rules will be submitted to the SWRCB for certification as BMPs.

8. BOF and USFS have: (a) initiated a process for developing a joint decision-making protocol for assessing and mitigating cumulative watershed effects in mixed ownership watersheds, and (b) suggested to the SWRCB that this process be used as a primary means of addressing any needed refinements in implementing cumulative watershed effects' assessments and in using the results in making land management decisions.

THEREFORE BE IT RESOLVED THAT THE SWRCB:

1. Certifies USFS Practice 3-1 and Practice 7-8 as BMPs.

2. Approves incorporation of these practices into the WQM Plan for NFS lands in California.

3. Approves amendment of the MAA with USFS by addition of the following language: During the period 1990-1995, USFS will utilize the BOF/USFS initiative for developing a joint decision-making protocol for mixed ownership watersheds as a primary means for: (a) making further refinements in the way that Practice 7-8 is implemented by USFS and in the way that its results are used by USFS in making land management decisions, and (b) improving compatibility between the USFS and BOF methods for cumulative watershed effects assessment.

4. Authorizes the Executive Director, or his designee, to: (a) execute the MAA amendment with USFS, and (b) submit to the U.S. Environmental Protection Agency a copy of each of the certified BMPs, this resolution, the amended MAA, and any related documents prepared by the SWRCB in accordance with any applicable State or Federal requirements.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on January 23, 1992.

Maureen Marché
Administrative Assistant to the Board

Exhibit 3

STAFF REPORT
BY THE
DIVISION OF WATER QUALITY
STATE WATER RESOURCES CONTROL BOARD

CERTIFICATION OF PROPOSED U.S. FOREST SERVICE BEST MANAGEMENT PRACTICES FOR WATER RESOURCE PROTECTION ON LOCATABLE MINERAL OPERATIONS AND FOR CUMULATIVE OFF-SITE WATERSHED EFFECTS ANALYSIS

The State Water Resources Control Board (SWRCB) has: (1) certified a plan titled, "Water Quality Management for National Forest System Lands in California" (WQM plan for NFS lands), (2) (2) designated the U.S. Forest Service (USFS) as the water quality management agency responsible for implementing the WQM plan for National Forest Systems (NFS) lands, and (3) executed a Management Agency Agreement (MAA) with USFS which specified USFS commitments to, among other things, develop best management practices (BMPs) for assessing cumulative off-site watershed effects (CWEs) and for water resource protection for locatable mineral operations.

Pursuant to the MAA commitments, the Pacific Southwest Region of the USFS has: (1) developed and submitted to the SWRCB two new practices: Practice 3-1, titled "Water Resource Protection on Locatable Mineral Operations" (Exhibit 1), and Practice 7-8, titled "Cumulative Off-Site Watershed Effects Analysis" (Exhibit 2), and (2) requested that the SWRCB certify these practices as BMPs in accordance with Section 208 of the Federal Clean Water Act. To be implemented by USFS pursuant to Section 208, the BMPs must be incorporated into the WQM plan for NFS lands.

The SWRCB has encouraged development and implementation of a single CWE assessment procedure for use on both NFS and non-Federal lands, but this has not yet been achieved. The USFS and California State Board of Forestry (BOF) have a mutual high-priority initiative for developing a joint decision-making protocol for assessment and management of CWEs in watersheds with a mixture of NFS and private lands. This initiative can be an effective vehicle for bringing about more similar CWEs assessment procedures.

The proposed USFS BMPs are designed to improve protection of the quality and beneficial uses of the State's waters without adverse effects on other environmental values. They were developed with considerable direct participation, review, and comment by the SWRCB, the California Regional Water Quality Control Boards (CRWQCB), BOF, the California Department of Forestry (CDF), and other interested parties. In earlier versions, Practice 7-8 was vigorously opposed by BOF and CDF because of concerns about its scientific validity. Other parties expressed concern about the way in which the practice was implemented.

The SWRCB held a hearing in July 1989 to receive comments regarding the acceptability of these proposed BMPs. Staff has prepared a responsiveness summary for the comments included in the hearing record. None of the comments provided evidence to indicate that the proposed BMPs should not be certified. Very few comments were received on Practice 3-1. Comments on Practice 7-8 indicated that, despite its weaknesses, the practice is a reasonable first step in the difficult problem of assessing CWEs on public lands. However the comments did indicate the following problems with Practice 7-8: (1) the proposed BMP is not scientifically rigorous, (2) it is sometimes implemented without adequate site-specific field study, and (3) when not properly implemented, it may not yield results which are reliable enough for USFS to make well-informed land management decisions. The timber industry requested that the SWRCB hold public workshops to address some of these concerns.

CWE assessment is new and complex subject. The USFS recognizes that the BMP is not scientifically rigorous. However, when properly implemented, Practice 7-8 provides a level of assessment which is adequate for making well-informed land management decisions. As for any BMP, there is a need to continuously refine and improve Practice 7-8, how it is implemented, and in the way the results are used. Improvements in the CWE assessment methodology itself will largely depend on improved science and technology, including knowledge gained from the BMP effectiveness monitoring program, which USFS initiated this year, the major USFS research in the area of CWEs, and the alternative CWE assessment procedures being considered by the Intermountain and Pacific Northwest Regions of USFS.

Improvements in implementation of Practice 7-8 and in making of related land management decisions will largely depend on cooperative efforts between USFS, BOF, CDF, and other interested parties. BOF and USFS have proposed and the SWRCB has agreed that the BOF/USFS initiative for developing a joint decision-making protocol could be an appropriate means for making needed refinements. This initiative is BOF's highest priority initiative for the next five years, and it has received a $50,000 grant of Federal monies through the SWRCB's Forest Activities Program.

The SWRCB has several alternatives regarding certification. These include denial of certification, delay until improvements are made, conditional certification, or unconditional certification with an agreement to pursue improvements. The practices both appear to represent substantial progress toward achievement of water quality objectives and to meet other Federal criteria for certification. By approving the BOF/USFS initiative, as the primary means for achieving refinements in implementation of Practice 7-8 and in the way in which the results are used for making timber land management decisions, the SWRCB can encourage the development of a more unified CWE assessment approach on both NFS and private lands, improvements in implementation of the practice, and in the use of the results. These benefits cannot be attained by denial or delay of certification. These benefits could be achieved either by conditional certification or by unconditional certification with an agreement between the SWRCB and USFS. As it is not yet possible to determine what substantive changes in the BMP would be appropriate, conditioning of certification would appear to be no more effective, but more bureaucratically burdensome, than simply amending the MAA to reflect USFS commitment to use the initiative process.

It, therefore, appears that the SWRCB can most effectively ensure that the needed changes are made by: (1) certifying the proposed BMPs, (2) incorporating them into the WQM plan for NFS lands, and (3) approving amendment of the MAA to specify that USFS will utilize the initiative as the primary means for (a) refining the way Practice 7-8 is implemented and the way in which the results are used in making timber land management decisions, and (b) improving compatibility between the USFS and BOF methods for CWE assessment. This could be accomplished by approving the proposed resolution and would improve protection of the quality and beneficial uses of water. No potentially adverse environmental effects are foreseen as a result of this action.

ENVIRONMENTAL CHECKLIST FOR PROPOSED ACTIONS OF THE STATE WATER RESOURCES CONTROL BOARD REGARDING BEST MANAGEMENT PRACTICES PROPOSED BY THE U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE

This environmental checklist summarizes the possible environmental impacts of the following actions by the State Water Resources Control Board (SWRCB): (1) pursuant to the Federal Clean Water Act, certifying as best management practices (BMPs) for water quality management in California the following practices proposed by the U.S. Forest Service (USFS): Practice 3-1, titled "Water Resource Protection on Locatable Mineral Operations", and Practice 7-8, titled "Assessing Cumulative Off-Site Watershed Effects" and (2) upon certification of the BMPs, amending the existing SWRCB-certified plan titled "Water Quality Management for National Forest System (NFS) Lands in California" by incorporation of the BMPs.

YES-MAYBE-NO

1. Earth. Will the proposal result in:

___ ___ x a. Unstable earth conditions or in changes in geologic substructures?

___ ___ x b. Disruptions, displacements, compaction, or overcovering of the soil?

___ ___ x c. Change in topography or ground surface relief features?

___ ___ x d. The destruction, covering, or modification of any unique geologic or physical features?

___ ___ x e. Any increase in wind or water erosion of soils either on or off the site?

___ ___ x f. Changes in deposition or erosion of beach sands or changes in siltation, deposition or erosion which may modify the channel of a river or stream, the bed of the ocean, or any bay, inlet, or lake?

___ ___ x g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?

YES-MAYBE-NO

2. Air. Will the proposal result in:

YES	MAYBE	NO	
		x	a. Substantial air emissions or deterioration of ambient air quality?
		x	b. The creation of objectional odors?
		x	c. Alteration of air movement, moisture, or temperature, or any change in climate, either locally or regionally?

3. Water. Will the proposal result in:

YES	MAYBE	NO	
		x	a. Changes in currents or the courses or direction of water movements in either marine or fresh waters?
		x	b. Changes in absorption rates, drainage patterns or the rate and amount of surface water runoff?
		x	c. Alterations to the course or flow of flood waters?
		x	d. Change in the amount of surface water in any water body?
		x	e. Discharge into surface waters or in any alteration of surface water quality, including, but not limited to, temperature, dissolved oxygen, or turbidity?
		x	f. Alteration of the direction or rate of flow of ground waters?
		x	g. Change in the quantity of ground waters, either through direct additions or withdrawals or through interception of an aquifier by cuts or excavations?
		x	h. Substantial reduction in the amount of water otherwise available for public water supplies?
		x	i. Exposure of people or property to water related hazards such as flooding or tidal waves?

YES-MAYBE-NO

4. Plant Life. Will the proposal result in:

___ ___ x a. Change in the diversity of species or number of any species of plants (including trees, shrubs, grass, crops, microflora, and aquatic plants)?

___ ___ x b. Reduction of the number of unique, rare or endangered species of plants?

___ ___ x c. Introduction of new species of plants into an area or in a barrier to the normal replenishment of existing species?

___ ___ x d. Reduction in acreage of any agricultural crop?

5. Animal Life. Will the proposal result in:

___ ___ x a. Change in the diversity of species or numbers of any species of animals (birds, land animals, including reptiles, fish and shellfish, benthic organisms, insects, or microfauna)?

___ ___ x b. Reduction of the numbers of any unique, rare, or endangered species of animals?

___ ___ x c. Introduction of new species of animals into an area or a barrier to the migration or movement of animals?

___ ___ x d. Deterioration of existing fish or wildlife habitat?

6. Noise. Will the proposal result in:

___ ___ x a. Increases in existing noise levels?

___ ___ x b. Exposure of people to severe noise levels?

___ ___ x 7. Light and Glare. Will the proposal produce new light and glare?

___ ___ x 8. Land Use. Will the proposal result in substantial alteration of the present or planned land use of an area?

YES	MAYBE	NO	Item
			9. Natural Resources. Will the proposal result in:
___	___	x	a. Increase in the rate of use of any natural resources?
___	___	x	b. Substantial depletion of any nonrenewable natural resources?
___	___	x	10. Risk of Upset. Does the proposal involve a risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals, or radiation) in the event of an accident or upset conditions?
___	___	x	11. Population. Will the proposal alter the location, distribution, density, or growth rate of the human population of an area?
___	___	x	12. Housing. Will the proposal affect existing housing or create a demand for additional housing?
			13. Transportation/Circulation. Will the proposal result in:
___	___	x	a. Generation of substantial additional vehicular movement?
___	___	x	b. Effects on existing parking facilities or demand for new parking?
___	___	x	c. Substantial impact upon existing transportation system?
___	___	x	d. Alterations to present patterns of circulation or movement of people and/or goods?
___	___	x	e. Alterations to waterborne, rail, or air traffic?
___	___	x	f. Increase in traffic hazards to motor vehicles, bicyclists, or pedestrians?
			14. Public Services. Will the proposal have an effect upon, or result in, a need for new or altered governmental services in any of the following areas:

YES	MAYBE	NO		
		x		a. Fire protection?
		x		b. Police protection?
		x		c. Schools?
		x		d. Parks or other recreation facilities?
		x		e. Maintenance of public facilities, including roads?
		x		f. Other governmental services?
			15.	Energy. Will the proposal result in:
		x		a. Use of substantial amounts of fuel or energy?
		x		b. Substantial increase in demand upon existing sources of energy or require the development of new sources of energy?
			16.	Utilities. Will the proposal result in a need for new systems or substantial alterations to the following utilities:
		x		a. Power or natural gas?
		x		b. Communication systems?
		x		c. Water?
		x		d. Sewer or septic tanks?
		x		e. Stormwater drainage?
		x		f. Solid waste and disposal?
			17.	Human Health. Will the proposal result in:
		x		a. Creation of any health hazard or potential health hazard (excluding mental health)?
		x		b. Exposure of people to potential health hazards?
		x	18.	Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?

YES-MAYBE-NO

___ ___ x 19. Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?

___ ___ x 20. Archeological/Historical. Will the proposal result in an alteration of a significant archeological or historical site, structure, object, or building?

21. Mandatory Findings of Significance.

___ ___ x a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife population, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?

___ ___ x b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time while long-term impacts will endure well into the future.)

___ ___ x c. Does the project have impacts which are individually limited, but cumulatively considerable? A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.

___ ___ x d. Does the project have environmental effects which will cause substantial adverse effects on human beings either directly or indirectly?

The proposed actions by the SWRCB are the only basis for this environmental evaluation. These actions would: (1) acknowledge that the BMPs proposed by the USFS represent substantial progress in achieving water quality goals and meet other Federal criteria for certification as BMPs and (2) add the BMPs to those already incorporated into the SWRCB-certified Water Quality Management Plan. As a SWRCB-designated water quality management agency, USFS is committed to reasonably implement BMPs incorporated into the plan in accordance with a SWRCB-approved Management Agency Agreement (MAA). The two proposed BMPs have been developed by USFS in accordance with the MAA after extensive public review and participation. Both practices have already been implemented by USFS and are designed to improve protection of water quality without detriment to other environmental resources.

Based on the above, I find that the proposed SWRCB action could not have a significant effect on the environment.

Date 12/16/91 Stanley M. Martinson
(Signature)

NOTICE OF FILING

TO: Any Interested Person

FROM: State Water Resources Control Board
P.O. Box 944213
Sacramento, CA 94244-2130

SUBJECT: Notice of Filing submitted under Section 21080.5 of the Public Resources Code (PRC)

Project Proponent: State Water Resources Control Board (SWRCB)

Project Title: U.S. Forest Service (USFS) Practice 3-1 and 7-8

Contact Person: Chris Chaloupka Telephone: (916) 657-0703

Project Location: National Forest System Lands

Project Description: SWRCB action to: (1) certify Practices 3-1 and 7-8 as best management practices (BMPs), (2) incorporation of the certified practices into the SWRCB-certified plan titled "Water Quality Management for National Forest System (NFS) Lands in California", and (3) establishment of a procedure for future improvements in Practice 7-8.

This is to advise you that the following have been filed: (1) USFS BMPs for assessing cumulative off-site watershed effects (Practice 7-8) and water resource protection for locatable mineral properties (Practice 3-1), (2) a document setting forth agreement by the SWRCB, State Board of Forestry, and USFS to a procedure for future improvements in Practice 7-8, and (3) a proposed SWRCB Resolution to implement the actions described above. Action on these documents will be taken in accordance with a regulatory program exempt under Section 21080.5 of the PRC from the requirement to prepare an environmental impact report under the California Environmental Quality Act (PRC Code Section 21000, et seq.) and with other applicable laws and regulations.

Copies of the proposed BMPs, proposed SWRCB Resolution, the Environmental Checklist Form, and a report concluding that the above action will not result in a significant adverse environmental impact can be obtained from the Contact Person named above.

Comments on the proposed action should be submitted by:

Date: January 22, 1992

[signature]

Signature of Person Transmitting Notice

Chief, Regulation Branch, Division of Water Quality

Title

1. Water Resources Protection On Locatable Mineral Operations (PRACTICE: 3.1)

a. Objective: To protect water quality from degradation by physical and chemical constituents resulting from locatable mineral exploration, development, production, and associated activities.

b. Explanation: The authority for the occupancy of NFS land for mineral development is granted under the General Mining Law, as amended (30 U.S.C. 21-54 et seq.), and various other statutes. The regulations (36 CFR 228, subpart A, and 36 CFR 261) promulgated under the Organic Act (16 USC 551) obligate both the mineral operator and the Forest Service to minimize adverse environmental impacts to the surface resources of National Forest System administered land (36 CFR 228.1).

It is the Forest Service's objective to ensure that all mineral activities are conducted in an environmentally sound manner and that lands disturbed by mineral activities are reclaimed for other productive uses (FSM 2802).

Since a mining operation usually involves activities, such as site clearance and road construction, other "Best Management Practices" should be implemented as warranted.

c. Implementation: Seven instruments may be used in governing the impact on surface resources, including water quality, of locatable mineral activities on National Forest System administered lands. It is not necessary to use all of them in every case. They are:

(1) Notice of Intention to Operate.

(2) Plan of Operations.

(3) Environmental Assessment and/or Environmental Impact Statement.

(4) Guarantee to Perform Reclamation Work.

(5) Special Use Permit.

(6) Road Use Permit.

(7) Notice of Noncompliance.

A Notice of Intention to Operate (NOI) is required from those intending to conduct mining operations which have the potential to cause disturbance of surface resources, including waters waters of the state, on National Forest lands. The NOI must include sufficient information concerning the mining activity to allow for an environmental analysis and determination of the need for a detailed Plan of Operations. Require a Plan of Operations from operators when mining actions will likely cause a significant disturbance of surface resources, including waters of the state. The Plan of Operation must be approved prior to commencing any work. Where environmental analysis of the NOI indicates that mining or mining related actions discharge or have the potential to discharge waste(s) into waters of the State, the operator must file a report of waste discharge with the appropriate Regional Water Quality Control Board. When such filing results in the issuance of waste discharge requirements (WDR) to the operator by the Regional Board; the discharge requirements shall become required provisions in the plan of operation for the mining activity. The Plan of Operation is approved and administered the Forest Service. The Forest Service, acting within its designated water quality management agency capacity, serves as the State's representative in assuring the provisions of the permit are attained. Where no WDR is issued but comments are provided by the Regional Board, the comments shall be used in the District Ranger's evaluation of the proposed project's water quality effects and identification of protection measures to be included in the Plan of Operation.

Mineral operations shall comply with all Federal and State laws related to the Clean Water Act, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the Resource Conservation and Recovery Act (RCRA).

The processes outlined in the National Environmental Policy Act (NEPA) and its implementing regulations (43 CFR 1500-1508) are used to evaluate a plan of operations for completeness and for compliance with law. Where the quality of waters of the state may be effected by the mining operation, Regional Board personnel shall be consulted in a timely manner to allow for input to the NEPA evaluation. In such cases, the responsible Forest Service official shall seek Regional Board staff review of the Plan of Operation and solicit their involvement in identifying methods and techniques to be applied for water quality protection. An EIS shall be prepared when projects have the potential to result in significant impacts to the environment. Prior to approval of the Plan of Operations, the operator may be required to furnish a "Guarantee to Perform Reclamation Work" in the form of approved surety bond or other security sufficient to cover the cost of reclamation work. When a bond is required, activity can not proceed under the Plan of Operations until the required security is on deposit with the authorized officer.

In addition to the waste discharge report and WDR provisions discussed above, operators are required to obtain special use permits for water diversion and transmission facilities, power line placement, road construction and/or reconstruction, tailings disposal and other surface disturbing or resource impacting actions on NFS land. Road use permits may be issued for commercial use of certain National Forest System roads. When a Plan of Operations is required, it must be approved prior to the issuance of any of these permits.

REFERENCES

3-1	FSM 1531.12a
3-1	FSM 1950
3-1	FSM 2522.14
3-1	FSM 2730.3
3-1	FSM 2734.4
3-1	FSM 2801, 2802, 2803
3-1	FSM 7730
3-1	R-5 FSM 2817
3-1	FSM 2817
3-1	FSM 2817.3
3-1	FSM 2810.1 & .4
3-1	FSM 2813.14 & .2
3-1	FSM 2814.11 - .16
3-1	FSH 2509.15
3-1	FSH 2809.11
3-1	FSH 2809.12
3-1	30 CFR 212 Transportation Regulations
3-1	30 USC 21-54 et. seq.
3-1	36 CFR 228.1; 228.4 (a),(e),(f); 228.8 (b),(c),(e),(f),(g); 228.5 (b)
3-1	36 CFR 261.10 (a)
3-1	16 USC 478
3-1	16 USC 551
3-1	16 USC 1151 et. seq.
3-1	NEPA
3-1	RCRA
3-1	CERCLA
3-1	30 USC 612

8. Cumulative Off-site Watershed Effects (Practice: 7-8)

a. Objective. To protect the beneficial uses of water from the combined effects of multiple management activities which individually may not create unacceptable effects but collectively may result in adverse (degraded) water quality conditions.

b. Explanation. Cumulative off-site watershed effects (CWE) include all effects on beneficial uses that occur away from the sites of actual land use activities and which are transmitted through the fluvial system. Effects can be either beneficial or adverse and result from the synergistic or additive effects of multiple management activities within a watershed.

Professional judgement is used to evaluate CWE susceptibility, on a watershed basis, as part of the decision-making process. These assessments are made utilizing known information about beneficial uses, climate, watershed charateristics, land use history, and present and reasonably foreseeable future land use activities. Initial evaluation of CWE susceptibility is based on what is known about the study watershed and other watersheds with similar physical and climatic characteristics. Comparison of land disturbance history and resulting impacts to beneficial uses in these watersheds results in an estimate of the upper limit of watershed tolerance to land disturbance.

c. Implementation. CWE susceptibility evaluations and development of mitigative measures are done through the EA process, using an interdisciplinary team approach and direction contained in R-5 FSH 2509.22, Chapter 20. Forests having similar climatic, watershed and land use charateristics work together to refine CWE assessments to sensitive to local conditions. Each forest conducts monitoring to determine the effectiveness of CWE analysis for reducing the risk of adverse CWE. Monitoring results are also used to refine the analysis and, where necessary, modify the analysis process.

FOREST SERVICE HANDBOOK
San Francisco, California

July 1988

R-5 FSH 2509.22 - SOIL AND WATER
CONSERVATION HANDBOOK

Amendment No. 1

POSTING NOTICE. Amendments to this title are numbered consecutively. Check the last transmittal received for this title to see that the above amendment number is in sequence. If not, order intervening amendments at once on form 1100-6. Do not post this amendment until the missing one(s) is received and posted. After posting, retain this transmittal until the next amendment is received. Place it at the front of the handbook behind the title page.

Page Code	Superseded (Number of Sheets)	New (Number of Sheets)
00	1	1
20--1 thru 25.34--2	-	16

Digest:

20 - Establishes chapter 20, Cumulative Off-Site Watershed Effects Analysis.

ANDREW A. LEVEN
Assistant Regional Forester
Range and Watershed Management

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

SOIL AND WATER CONSERVATION HANDBOOK

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SOIL AND WATER CONSERVATION HANDBOOK

CHAPTER 20 - CUMULATIVE OFF-SITE WATERSHED EFFECTS ANALYSIS

ZERO CODE

This chapter describes the cumulative off-site watershed effects (CWE) assessment procedure used on National Forest System (NFS) lands within the State of California. Known information used in the analysis produces an objective, reproducible, and professional assessment of the combined effects of all past, present and reasonably foreseeable future management actions on downstream beneficial uses of water. Application of the procedure is guided by a conceptual CWE model. Both the model and procedure are refined and modified as results of monitoring and technical studies become available.

This chapter limits the scope of the methodology to only evaluating the susceptibility of CWE on downstream beneficial uses of water. The procedure is useful for evaluating both beneficial and adverse CWE. Beneficial effects may result from management actions such as watershed improvement projects and special project mitigation. Adverse effects may result from multiple land uses activities which combine to cause detrimental changes in watershed hydrology or sedimentation from landsliding and soil erosion.

The procedure described in this chapter is similar to decision making models which use relative rankings and weightings (for example, Kepner-Tregoe, 1973). Known information about natural processes and land use effects is used to evaluate CWE susceptibility as part of the environmental analysis process (FSH 1909.12; FSH 1909.15; FSM 1910, 1920 & 1950). Its purpose is to:

1. Assist forest managers in scoping issues and concerns during planning and to identify areas that require additional evaluation of CWE-related issues.

2. Identify beneficial uses of water and watershed, climatic and land use factors that combine to influence the identified beneficial uses.

3. Use existing information to assess the influence of multiple land use activities on beneficial uses of water.

Analysis of cumulative watershed effects is a young and expanding field. Although knowledge of the subject is limited, enough is known to develop reasonable estimates of CWE susceptibility. Given the limits of current knowledge, application of the procedure requires considerable professional judgement. It is important that an interdisciplinary team conduct the assessment and that the team's professional judgement temper any formulas or numbers the team develops.

20.1 - Authority. The principal Federal laws influencing the Forest Service's efforts to evaluate CWE include the following:

1. Organic Administration Act of June 4, 1897. This Act emphasizes that the National Forests were created to improve and protect the forest within the boundaries; to secure favorable water flows; and to furnish a continuous supply of timber for the use and necessities of the citizens of the United States.

2. National Environmental Policy Act (NEPA) of January 1, 1969. NEPA promotes efforts which will minimize environmental damage and develop an understanding of the interrelationships of all components of the natural environment and the effects of human activities on the environment. It requires that direct, indirect and cumulative effects be considered when conducting an environmental analysis.

3. Clean Water Act of 1972, as amended in 1977 and 1980. Section 208 of the Clean Water Act required the States to prepare non-point source pollution plans which were to be certified by the State and approved by the Environmental Protection Agency (EPA). In response to this law, and in coordination with the State of California Water Resources Control Board (SWRCB) and EPA, Region 5 began developing Best Management Practices (BMP) for water quality management planning on National Forest System lands within the State of California in 1975. This process identified the need to develop a BMP for addressing the cumulative off-site watershed effects of forest management activities on the beneficial uses of water.

20.2 - Objective. This chapter sets forth guidance for evaluating CWE susceptibility resulting from forest management activities.

20.3 - Policy. It is Region 5 policy to address cumulative watershed effects in Regional, Forest and project planning and to initiate mitigation measures to minimize the risk of significant, adverse impacts on beneficial uses of water.

20.4 - Responsibility

1. Regional Forester. Develop and document a procedure for assessing CWE potential that has Region-wide application. Conduct training in applying and monitoring the procedure. Exercise quality control of Forests' analysis of CWE.

2. Forest Supervisor. Assess and evaluate CWE during Forest Land and Resource Management Planning. Develop and document standards and guidelines in Forest Land and Resource Management Plans for evaluating and monitoring CWE during Forest Plan implementation.

20.5 - Definitions

1. Abbreviations.

BMP - Best Management Practices

CRM - Coordinated Resource Management Plan

CWA - Clean Water Act

CWE - Cumulative Off-Site Watershed Effects

EA - Environmental Analysis

EPA - Environmental Protection Agency

ERA - Equivalent Road Acres

FSH - Forest Service Handbook

FSM - Forest Service Manual

ID - Interdisciplinary

NEPA - National Environmental Policy Act

NFS - National Forest System

RRP - Resource Recovery Program

SWRCB - State Water Resources Control Board

TOC - Threshold of Concern

2. Glossary of Terms

Beneficial Use. A use of the waters of the State including but not necessarily limited to domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetics; navigation; and protection and enhancement of fish, wildlife, and other aquatic resources or preserves.

Best Management Practice (BMP). A practice or a combination of practices, that is determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals. BMPs are certified by the SWRCB and approved by EPA, in compliance with Section 208 of the Clean Water Act (P.L. 92-500).

Cumulative Impacts. The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cumulative Off-site Watershed Effects (CWE). All effects on beneficial uses of water that occur away from the locations of actual land use which are transmitted through the fluvial system. Effects can be either beneficial or adverse and result from the synergistic or additive effects of multiple management activities within a watershed.

Extremely Unstable Lands. Areas highly susceptible to landsliding. Land areas exhibiting one or more of the following characteristics are examples of extremely unstable lands:

a. Active landslides.

b. Valley inner gorge.

c. Portions of shear zones and dormant landslides having slope gradients greater than about 60 percent to 65 percent.

d. Slopes underlain by unconsolidated deposits where the slope gradients are at or steeper than the angle of repose of the materials. The angle of repose is commonly between 60 and 75 percent for deposits such as stream terrace deposits, glacial moraines, and colluvial deposits.

e. Previously unfailed lands determined to be marginally stable, based on principles of soil and rock mechanics or previous experience with similar lands.

Forest Planning. Forest-wide land and resource management planning (FSM 1906.13a).

Interdisciplinary (ID) Team. A group of two or more individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. The members of the team proceed to solution with frequent interaction so that each discipline may provide insights to any stage of the problem and disciplines may combine to provide new solutions.

Project Planning. Project planning deals with how a particular project will be designed and implemented. The degree of planning varies according to the complexity of the project (FSM 1906.21).

Riparian. In general terms, the land bordering a stream, lake or tidewater.

Riparian Area. A geographically delineated area with distinctive resource values and characteristics that is comprised of the aquatic and riparian ecosystem.

Riparian Ecosystem. The transition area between the aquatic ecosystem and terrestrial ecosystem, identified by soil characteristics and distinctive vegetation communities that require free or unbound water.

Valley Inner Gorge. A geomorphic feature consisting of the unbroken slope adjacent to a stream channel which usually has a slope gradient of 65 percent or greater. The inner gorge is identified as the area of channel side slope situated immediately adjacent to the stream channel and extending upward to the first break in slope above the stream channel.

Debris sliding and avalanching, which are the dominant mass wasting processes in this zone, may result from recent oversteepening of the inner gorge zone by stream incision as well as from reactivation of rotational-translational slide toe zones within the inner gorge.

21 - FOREST SERVICE INTERNAL USE

21.1 - Internal Use. Use the CWE analysis to address off-site effects of multiple land use activities on beneficial uses of water. When applying this analysis assume that implementation of BMPs will mitigate on-site impacts of activities on water quality.

21.2 - Mixed Ownership Watersheds. Evaluating CWE in watersheds of mixed ownership may present a difficult and complex management situation. Often, actions of non-Forest Service landowners are unknown so scheduling of National Forest System (NFS) land use activities to minimize the risk of incurring adverse CWE is uncertain. When considering management options in mixed ownership watersheds, current Forest Service strategy is to apply them on the basis of the percentage of land ownership, thus proportioning the amount of disturbance contributed by any one ownership.

Forest Service managers should work with other landowners and managers to develop Coordinated Resource Management Plans (CRM) for watersheds where CWE have the potential to result in irreversible and irretrievable impacts to beneficial uses of water. In the absence of a CRM, managers should make a reasonable effort to obtain planning-level land use information from other landowners and managers. Failing the formulation of a CRM and acquisition of needed information from other owners, managers should use knowledge of historic use, trends and best professional estimates to forecast future actions on other lands. In the absence of any information, managers may have to assume that all lands of other ownership are completely disturbed to the maximum extent. This will establish a "heavy disturbance" scenario, so that when including proposed forest activities, managers can state that CWE is expected to either occur or not occur.

22 - MODEL

22.1 - Overview. Any model for evaluating CWE needs to identify what the concerns are and recognize limitations in the current scientific understanding of the problem. It must also bring together what is currently known about assessing the problem in a way that is flexible to local conditions and able to incorporate new information.

Limitations in the state of the art precludes development of a quantitative, process-based model to predict the absolute potential for CWE. Experience indicates that CWE susceptibility is best evaluated using conceptual models. These models attempt to predict the degree of risk of initiating adverse CWE by providing a framework in which to assemble relevant knowledge necessary to answer the following questions:

1. What are the beneficial uses of water and where do they occur?

2. What are the important factors influencing those uses?

3. How might multiple management activities affect the beneficial uses?

4. Where and under what circumstances will CWE occur?

5. How can CWE be mitigated?

6. How long will it take for an adversely impacted use to recover to within acceptable limits?

The intent of the model is to estimate the potential for CWE by utilizing current knowledge and experiences in other watersheds having similar characteristics. The model presented in this chapter is one method of bringing together knowledge and experiences relevant to assessing CWE. It requires an interdisciplinary team of resource staff to estimate CWE susceptibility. This estimate is based on their, and others, combined experiences and knowledge.

The model first approximates the importance of CWE and helps identify possible cause and effect relationships influencing CWE. The approximations are reevaluated and modified, as required, as new information becomes available from monitoring, field experiences and published studies. Use of the model in this manner provides an objective, reproducible and rational evaluation of CWE in forest and project planning.

<u>22.11</u> - <u>Cumulative Off-Site Watershed Effects</u>. In the context of this chapter, CWE is the concern being assessed. CWE includes all effects on beneficial uses of water that occur away from the locations of actual land use and are transmitted through the fluvial system. CWE impacts result from the combined effects of multiple management activities within a watershed. Individual effects can combine linearly or nonlinearly to produce undesirable downstream CWE.

Cumulative effects may result from changes in watershed hydrology, sedimentation rates (landsliding and/or surface soil erosion) and water temperature or chemistry that result from multiple land management activities. Procedures described in this chapter are best suited for monitoring changes in watershed hydrology and sedimentation rates.

Indicators of CWE vary, depending upon watershed characteristics, climatic regime and water-related values of concern. For example, in areas where fish habitat is the primary concern, changes in channel morphology or aquatic biologic diversity may be primary indicators that unacceptable changes are occurring.

Unacceptable CWE can be manifest over different time frames. For example, sediment may be introduced and routed through the system soon after a group of land disturbing activities have occurred. This may result in a short-term reduction in aquatic habitat quality, drinking water quality or some other beneficial use. In another situation unacceptable CWE may not be manifest for a number of years following intensive land use in a watershed. In this case initiation of CWE may occur only after a triggering climatic event. Impacts resulting from this event may cause significant and long-term reduction in fish habitat and other beneficial uses.

22.12 - State of the Art and Practice. Modeling CWE is not a precise science; it is a young and developing field. Development of a quantitative, statistically valid, technical model for assessing CWE is not now possible because ecological and geomorphic systems are complex and vary from one watershed to another. No one technical model will reasonably simulate all variables for all ecological and geomorphic systems. Adding to the complexity of the situation are limitations in understanding geomorphic processes in mountainous terrain and influences of climate and human activities on process rates and resulting impacts to down stream beneficial uses of water.

Recent studies demonstrate that it is possible to estimate CWE susceptibility by identifying and monitoring important variables (for example, Farrington & Savina (1977), Seidelman, et al. (1977), Coats & Miller (1981), Wolfe (1982), Haskins (1983), Lyons & Beschta (1983), Grant, et al.(1984)). Results of these types of studies and our own experiences working with forest management issues lead to the conclusion that the following variables, at least, need consideration in an integrated manner when evaluating CWE:

1. Beneficial uses of water.

2. Hillslope and stream channel characteristics.

3. The nature, amount and location of geomorphically and biologically sensitive lands within each watershed.

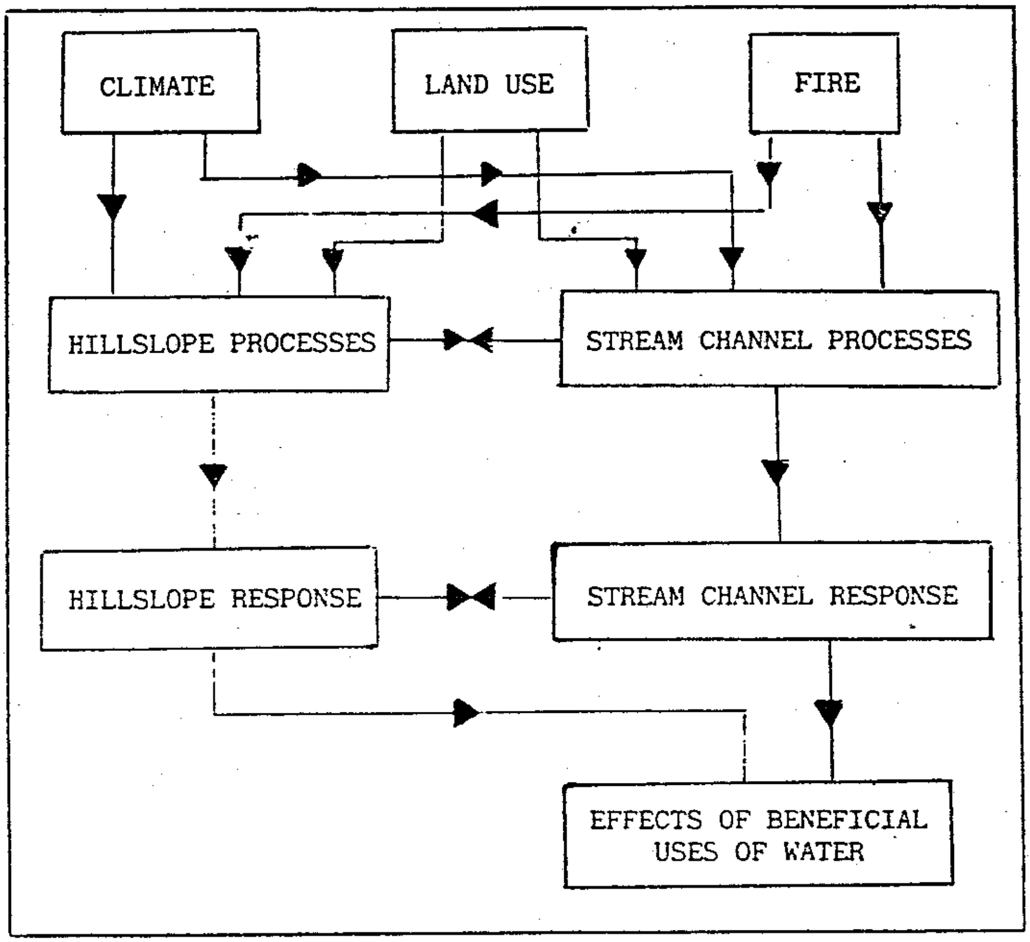
4. Type, location, extent and timing of management disturbances within each watershed.

5. The nature, location and extent of land disturbing activities relative to sensitive lands.

6. Cause and effect relationships of human activities and climatic events on beneficial uses of water.

22.2 - Conceptual Model. Occurrence of adverse CWE results from the interaction of many related variables. These include: beneficial uses of water; geology; watershed geomorphology and hydrology; soils; climate; wild fire and land use. Exhibit 1 is a flow diagram that depicts the conceptual model for the relative relationships of these major variables.

EXHIBIT 1


CLIMATE
LAND USE
FIRE
HILLSLOPE PROCESSES
STREAM CHANNEL PROCESSES
HILLSLOPE RESPONSE
STREAM CHANNEL RESPONSE
EFFECTS OF BENEFICIAL USES OF WATER

22.21 - Assumptions. The procedure described in section 23 is based on conceptual model described in section 22.2 and the following assumptions:

1. Beneficial uses of water can be identified and acceptable degradation limits established for each use.

2. Key indicators of unacceptable degradation can be identified for each use or value and these indicators monitored over time.

3. For a given hydrologic event, or sequence of events, an upper limit of tolerance to disturbance exists for each watershed. The risk of initiating adverse CWE greatly increases as this upper limit is approached and exceeded. The upper limit of tolerable disturbance may represent a geomorphic, biologic, management or legal threshold.

4. Traditional management practices can cause severe adverse impacts when applied to sensitive lands through human error, misunderstanding, or incomplete knowledge of the landscape.

5. The potential for initiating adverse CWE can be reduced by:

a. Limiting management practices on highly sensitive lands to those required to maintain or improve water quality and land stability.

b. Dispersing land disturbing activities in time and space.

c. Controlling the physical size, shape, location and timing of land disturbing activities (for example, timber harvest units, prescribed burn areas).

d. Implementing other BMPs to mitigate adverse on-site effects.

6. In most cases, watersheds will not reach or exceed an upper limit of tolerable disturbance, provided that assumption 5 is reasonably implemented.

23 - PROCEDURE

23.1 - Overview. This procedure is based on the model and assumptions described in section 22. Use this procedure to use known information when evaluating CWE susceptibility in the decision-making process. Its application is similar to that of other decision making models (for example, Kepner-Tregoes, 1973) for which finite information is not available. Known information is compiled and evaluated. Significant factors are identified and given numerical ratings based on their relative importance. The results of weighting and adding these numerical values is used to represent differences in alternatives. Often an iterative process is used to adjust these numerical values, based on professional judgement, until the output of the model best represents observed conditions.

Physical, biologic, climatic and land use factors are identified and evaluated based on their relative importance. For example, land use practices are given numerical disturbance values, relative to the nature and degree of land disturbance and the probable mechanism for initiating CWE. These values are then decayed over time to reflect the rate at which the disturbed sites recover to their natural condition.

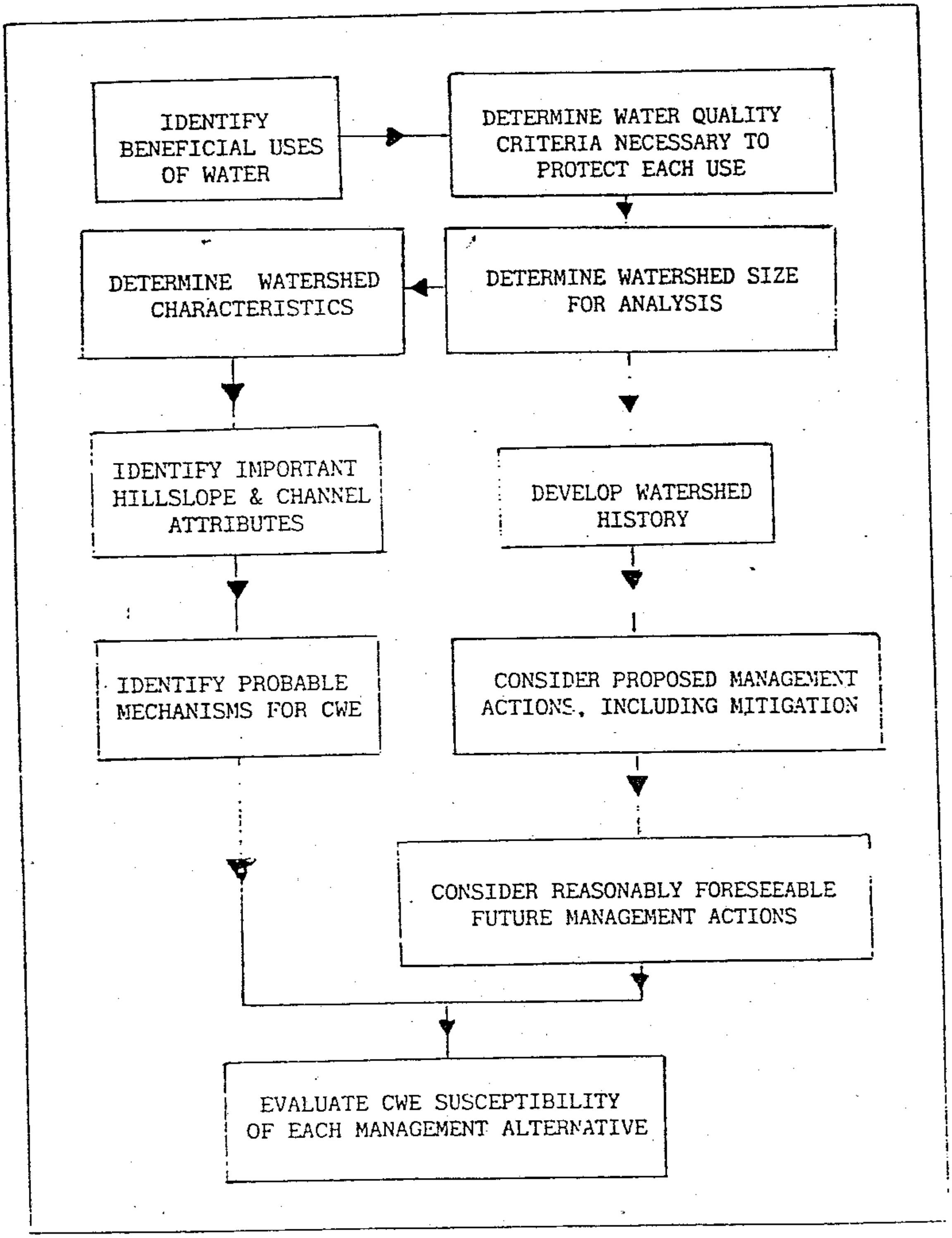
Changes in land disturbance levels over time are tracked through an accounting system that keeps track of these changes in numerical valves. Watershed boundaries delineate the basic area of analysis. Haskins (1986) discusses implementation of the model for use on the Shasta-Trinity National Forests for identifying, rating and monitoring these factors.

Estimating the ability of watersheds to tolerate land use activities is made by observing watersheds with similar physical and biologic characteristics and which are subjected to similar climatic conditions. These observations are made using a variety of information including aerial photography, stream channel inventories, land use history (including changes in management practices over time), resource inventories, and other relevant information.

Upper limits of watershed tolerance to land use are estimated. This upper disturbance limit is called the Threshold of Concern (TOC). It is estimated by grouping watersheds with similar characteristics, then identifying watersheds where down-stream beneficial uses of water have definitely been adversely impacted and those where the uses have definitely not been adversely impacted. The first approximation of the TOC is then made, by professional judgement, somewhere between the two limits. Future field investigations, published studies and the results of long-term monitoring are used to reevaluate and modify these initial estimates.

The procedure for evaluating CWE susceptibility requires consideration of factors shown in Exhibit 1.

EXHIBIT 1


IDENTIFY BENEFICIAL USES OF WATER
DETERMINE WATER QUALITY CRITERIA NECESSARY TO PROTECT EACH USE
DETERMINE WATERSHED CHARACTERISTICS
DETERMINE WATERSHED SIZE FOR ANALYSIS
IDENTIFY IMPORTANT HILLSLOPE & CHANNEL ATTRIBUTES
DEVELOP WATERSHED HISTORY
IDENTIFY PROBABLE MECHANISMS FOR CWE
CONSIDER PROPOSED MANAGEMENT ACTIONS, INCLUDING MITIGATION
CONSIDER REASONABLY FORESEEABLE FUTURE MANAGEMENT ACTIONS
EVALUATE CWE SUSCEPTIBILITY OF EACH MANAGEMENT ALTERNATIVE

23.2 - Beneficial Uses of Water. The first step in evaluating CWE is to determine which downstream beneficial uses of water might be affected by multiple management activities and where each occurs in the channel system. Examples of downstream values include:

1. Aquatic habitat.

2. Recreation.

3. Water supply.

4. Flood control.

5. Reservoir storage.

6. Power generation.

23.21 - Water Quality Protection Criteria. Determine protection criteria for each identified beneficial use. Identify indicators of unacceptable disturbance for each use.

23.3 - Watershed Size. Watershed boundaries form the basic area of analysis regardless of land ownership patterns or administrative boundaries. It is necessary to conduct the CWE evaluation on entire watersheds as changes in fluvial morphology and resulting impacts on beneficial uses of water result from the interaction of activities on all lands within the watershed.

Appropriate watershed sizes for analysis are determined by resource staff conducting the CWE evaluation. Use information about the nature of the project, beneficial uses of water and watershed charateristic to guide selection of watershed size. Experience to date suggests that fourth and fifth order watersheds commonly form analysis areas for forest planning while second and third order watersheds are often evaluated for project planning. Other important considerations include project size and special project characteristics.

23.4 - Watershed Characteristics. Identify and describe physical and biological watershed attributes, and their relationships, to develop a general understanding of the watershed system and factors that may influence watershed response to land use. This information is also useful for identifying general similarities and differences between groups of watersheds, and for determining the types of investigations necessary when considering CWE.

As a minimum, characterize watersheds in terms of their climate, hillslope and stream channel geomorphology, hillslope and stream channel hydrology, soils, geology, and physically and biologically sensitive land units.

23.41 - Climate. Climate influences watershed response to land use. There are several variables to consider when characterizing the climate of an area. However, in a given locale it is often possible to identify and consider certain key climatic factors. Experiences to date indicate that key factors often include climatic regime, annual precipitation and intensity and duration of precipitation. Climatic regimes are broadly identified as rain-dominated, snow-dominated or rain-on-snow (transient snow zone).

Determine key climatic factors. Climatic regime is a basic factor to be considered in all watersheds. Watershed specific concerns will guide determining which other factors are key. For example, precipitation patterns and intensities are important in watersheds containing landslides. In addition, certain climatic events may prove to be important factors.

Factors that influence selection of significant, or indicator, climatic events include: watershed morphology, stream channel sensitivity, beneficial uses of concern and the ability of the hillslope and stream channel to experience the event without significantly impairing water quality values.

23.42 - Hillslope and Stream Channel Attributes. Geomorphic, biologic and hydrologic attributes of hillslopes and stream channels often provide sensitive indicators of watershed response to land use. In addition, it may be possible to apply knowledge of attribute response to climate and land use in one area to other, similar areas where direct information is not available.

Use existing inventories to identify important hillslope and stream channel characteristics. For watersheds where inventories and surveys are incomplete, use knowledge of watersheds with similar geomorphic and hydrologic attributes to estimate important relationships. Conduct additional inventories and surveys, as required, to develop needed information.

Use the following types of inventories and sources of information for identifying and evaluating hillslope processes:

1. Geologic Resource Inventory (FSM 2880)

2. Landslide identification and analysis (for example: Sidle, et al, 1985; Varnes, 1978)

3. Soil Resource Inventory (FSH 2509.18)

4. Ecosystem Classification (FSH 2090.11)

Use the following types of information and inventories to evaluate channel processes by:

1. Stream channel classification based on morphological characteristics (Rosgen, 1985)

2. Current channel condition (Pfankuch, 1978)

Riparian ecosystems are often associated with streamside areas that form the boundary between hillslopes and stream channels. They can, however, occur at almost any area within a watershed system. For these reasons, riparian areas may not be adequately considered when using the types of inventories, surveys and information listed above. Use Riparian Area Management (Chapter 40) and other guidelines to identify riparian area attributes.

23.5 - Mechanics for Initiating CWE. Use information developed from sections 23.2 and 23.5 to identify possible mechanisms for initiating CWE, including:

1. Changes in hillslope and stream channel hydrology.

2. Chronic sedimentation.

3. Pulse sedimentation.

4. Changes in woody debris.

The dominant mechanism may change with location in the stream channel system. These changes may result from either changes in beneficial uses or channel characteristics. For example, changes in watershed hydrology and woody debris may be the dominant mechanisms in steep, first to third-order channels containing significant inner gorge reaches; changes in sediment budget and routing may be the dominant mechanisms in low gradient third-order, and larger channels in the same system.

Identification of the most probable mechanism(s) for CWE allows investigators to ask questions and refine the conceptual model and procedure to focus on important physical and biological relationships and concerns.

23.6 - Watershed History. Develop a watershed history of land use and significant natural events. Review historical records for all past land use activities and natural events occurring in the watershed, regardless of land ownership or administrative boundaries.

Land use information should disclose, as a minimum: the activity, when and where it occurred, estimates of initial site impacts and time necessary for the site to recover to its natural condition.

Information needed for natural events such as wild fire, landsliding and major storms is similar to that required for land use activities. It may, however, be necessary to use information from outside the watershed to estimate frequency and magnitude of occurrence for the natural events.

Relate, if possible, changes in watershed disturbance to changes in hillslope and stream channel condition and resulting impacts on down-stream, beneficial uses of water.

23.61 - Natural Watershed Sensitivity. Natural watershed sensitivity is an estimation of a watershed's natural ability to absorb land use impacts without increasing CWE susceptibility to unacceptably high levels. The measure of susceptibility to CWE may be a geomorphic or biologic threshold, or some more restrictive management or legal limit.

In general, natural watershed sensitivity to land use increases as the percentage of sensitive lands and stream channels in the watershed increases. Examples of highly sensitive land units include:

1. Active landslides.
2. Portions of dormant landslides.
3. Valley inner gorge.
4. Riparian areas.
5. Meadows.
6. Slopes greater than 80 percent.
7. Very highly erodible soils.

Other land generally considered sensitive but having less influence on watershed sensitivity include:

1. Non-riparian ephemeral drainages.
2. Soil covered areas immediately down slope from rock out crops.
3. Areas near active landslides and valley inner gorges.
4. Slopes between 60 and 80 percent.
5. Highly erodible soils.

Land units do not contribute equally to natural sensitivity. Location of sensitive lands within the watershed also influences watershed sensitivity. Use professional judgement to determine the relative importance of each attribute when estimating watershed sensitivity. For example, the more sensitive land units may be given a weighted importance 2 to 10 times greater than other, less significant units. The ID team sets the weights based on available information, field observations and aerial photo interpretation. See Haskins (1986) for an example of how to select and weigh these attributes.

Use information gathered in sections 23.4 through 23.6 to estimate natural watershed sensitivity. Give special consideration to stream channel sensitivity as determined by stream channel classification (Rosgen, 1985) and landslide inventory (FSM 2880).

Estimate the sensitivity of watersheds relative to one another. Do this by grouping together watersheds having similar climatic, physical and biologic attributes and which have similar amounts of sensitive land units. Compare and rank the watershed groups into high, moderate and low sensitivity classes. Use the following process to approximate the relative sensitivity of one watershed to another, and one group of watersheds to another:

1. Map land units according to their physical and biologic attributes.

2. Evaluate stream channel morphology and sensitivity.

3. Establish relative weights of the importance of each attribute regarding sensitivity to disturbance from land use.

4. Multiply the percentage of various attributes (land unit acreage/total watershed acres) by the relative weight.

5. Accumulate the weighted extent of the attributes for each watershed. The watershed with the largest accumulated value has the greatest natural sensitivity to disturbance.

6. Group together watersheds having similar climate, stream channel characteristics and natural sensitivity values. For general planning purposes, rank the groups of watersheds into high, moderate or low natural sensitivity classes.

Geomorphic and climatic processes vary widely throughout Region 5. Therefore, generally confine grouping of watersheds to reflect relative sensitivity, to geographic areas that fit local needs.

23.62 - Watershed Tolerance To Land Use. Watersheds with a high natural sensitivity can tolerate less land disturbance and require greater care in planning land use activities than watersheds with a low sensitivity. As the amount of land use increases within a watershed, the susceptibility of that watershed to CWE increases. There is a point where additive or synergistic effects of the land use activities will cause the watershed to become highly susceptible to CWE.

Estimate the upper limit of watershed tolerance to externally applied factors such as climate and land use. This upper tolerance limit is influenced by the extrinsic effects of both climate and land use. Address climatic effects by:

1. Considering climatic influences on watershed processes (section 23.4).

2. Using known information regarding climatic influences of watershed response to land use impacts.

3. Holding climatic influences relative constant by requiring only watersheds with similar climate be grouped together for comparative analysis (sections 23.4 and 23.61).

Impacts resulting from land use then become the primary extrinsic variable tracked. This estimated upper limit to land use is called the Threshold of Concern (TOC). Estimate the TOC by comparing land use histories and resulting impacts on beneficial uses in similar watersheds. Estimating the TOC is an iterative, multi-stepped process that includes:

1. Determining natural watershed sensitivity as described in section 23.61.

2. For each group of watersheds identified in section 23.61, Item 6:

a. Establishing land use history as described in section 23.63.

b. Observing adverse changes in stream channel condition and resulting effects on beneficial uses of water.

c. Identifying watersheds where significant, adverse CWE have definitely occurred and those where CWE have definitely not occurred. Characterize land disturbance history for each group of watersheds in terms of disturbance coefficients (section 23.63) and narrative explanations of the observed cause-effect relationships. Also document any observations and other information regarding recovery rates of both on-site and off-site, downstream impacts.

3. Use information developed in Items 1 and 2 to estimate TOC. The TOC for each group of watersheds will occur somewhere between the two limits established in Item 2c. Use professional judgement to make the initial estimate of where the TOC lies between those two limits.

The TOC does not represent the exact point at which cumulative watershed effects will occur. Rather, it serves as a "yellow flag" indicator of increasing susceptibility for significant adverse cumulative effects occurring within a watershed. Susceptibility of CWE generally increases from low to high as the level of land disturbing activities increase towards or past the TOC.

4. Adjust TOC estimates, as required, based on new information and monitoring results.

23.63 - Land Disturbance. Land use activities often result in the alteration of natural physical and biological watershed attributes. The nature, severity and persistence of site disturbance resulting from a land use activity is often difficult to quantify because it is a function of the land use activity, where it occurs and how well the activity is done. This difficulty in quantification is especially true when one type of activity is compared with another (for example, timber harvesting, summer residences, grazing and camping).

It is for this reason that normalized, numerical disturbance coefficients are used to track overall land disturbance within watersheds. The coefficients are estimates of land disturbance as they relate to probable mechanisms for initiating CWE (section 23.5) and resulting impacts to downstream, beneficial uses. They provide a standardized unit of measure for comparing the land disturbing effects of a wide range of land use activities.

23.63a - Site Disturbance. Develop normalized numerical disturbance coefficients to estimate land disturbance resulting from existing and proposed land use activities. These coefficients are estimates of the effects of land disturbance as it relates to alteration of hillslope and stream channel attributes and the influence those alterations have on identified mechanisms to initiate CWE.

Estimation of land disturbance coefficients relies on interdisciplinary professional judgement. Use techniques such as visual observation, field surveys, published studies, transects and aerial photo interpretation to estimate land disturbance coefficients.

Develop coefficients that reflect modification of:

1. Woody debris attributes, when identifying changes in woody debris as a probable mechanism for initiating CWE.

2. Hillslope stability and sediment budgets and routing, when identifying pulse or chronic sedimentation as probable mechanisms for initiating CWE.

3. Compacted surface, interception of groundwater, changes in groundwater recharge or storage, and efficiency in water delivery to stream channels when identifying alteration of watershed hydrology as a probable mechanism for initiating CWE.

23.63b - Mitigation Measures. Consider the effectiveness of mitigation measures in reducing the susceptibility of adverse CWE. The effectiveness of mitigation measures is reflected in initial disturbance coefficients, recovery rates and narrative documentation of CWE analyses.

Mitigation measures are accomplished in one of two ways. The first is during project planning, design and implementation. This type of mitigation, includes avoidance of problem areas and, as it relates to beneficial uses of water, application of BMPs during project design and implementation. Appropriate BMPs are identified during environmental assessment and designed based on site-specific concerns and objectives. Numerous mitigation measures can be employed to individual management practices to lessen both site-specific impacts and CWE susceptibility. The following are some examples:

1. Increasing width of stream management zones.

2. Temporarily closing and revegetating system roads.

3. Placing slash along fill slopes near stream management zones to intercept sediment from the road prism.

4. Cool burning timber harvest slash rather than piling and burning or using a hot burn.

5. Outsloping the road bed to disperse surface runoff rather than concentrating runoff in inside road ditches.

Remedial measures constitute the second group of mitigation measures. The objectives of these measures are to repair site specific problems, improve overall watershed condition and reduce CWE susceptibility. Landslide stabilization, road drainage improvement, obliteration of roads, and timber stand reforestation are examples of remedial measures that tend to reduce CWE susceptibility and improve watershed recovery. Construction of these projects is also an effective way to reduce existing site disturbance.

Modify site disturbance coefficients to reflect the quality of BMP implementation and the effects of constructed remedial measures.

23.63c - Site Recovery. Areas disturbed by land use often tend to return to their natural (undisturbed) state over time. Recovery rates are variable and dependent upon many factors, including the type and extent of disturbance, soils, climate, rate of revegetation and rate of dechannelization of water from roads, skid trails and cable corridors.

Site recovery generally occurs in a nonlinear manner. A considerable percentage of recovery may occur during the first few years after completion of the land-disturbing activity. In other situations, however, sequential management activities may cause increasing disturbance levels for a few years before site recovery may begin. The lack of data required to develop accurate curves limits the use of nonlinear curves.

The ID team develops site recovery curves. The team bases its first approximation of site recovery rates on experience and consideration of factors such as rate of dechannelization of artificially channelized water, percent area in vegetative cover, presence or absence of hydrophobic soils, and other local factors of importance. The ID team shall use future field evaluations and results of monitoring to modify their first approximations.

23.63d - Land Use History. Develop land use history by reviewing historical records for all past activities in the watershed, regardless of land ownership or administrative boundaries. It is sometimes not possible, or even essential, to develop a detailed, highly accurate management history. In these instances, studying available resource aerial photography (scales of 1:15,840 & 1:24,000) taken over the past 20 to 30 years generally provides the detail of information required to conduct the analysis.

23.63e - Current Watershed Disturbance. Develop an estimate of current watershed disturbance by assigning forest-developed site disturbance coefficients to each identified land use. Consider changes in forest practices that have occurred over time when developing and assigning disturbance coefficients. Use site recovery curves and effects of mitigation to decay initial site disturbance over time to determine current watershed disturbance.

23.7 - Proposed Land Use. Identify the proposed land uses considered in the environmental analysis. Determine watersheds where the proposed activities are to occur. Using information previously developed, delineate watershed boundaries for CWE analysis (section 23.3). Use planning records and other appropriate information (section 21.2) to identify reasonably foreseeable future land uses in the watersheds to be analyzed.

Use known information to estimate land disturbance resulting from each of the proposed actions. Estimate the nature, extent and duration of disturbance of each proposed action.

23.8 - CWE Susceptibility Evaluation. Use information developed in section 23 to evaluate existing and potential CWE susceptibility of each proposed action. As previously explained, evaluation of CWE susceptibility is based on what is known about the study watershed and other watersheds with similar physical, climatic and biological characteristics.

Explain CWE susceptibility in terms of existing and potential future impacts on beneficial uses. Identify possible modifications of land use plans and remedial measures to mitigate existing or potential adverse CWE.

23.9 - Documentation. Document the CWE evaluation performed as part of the environmental analysis for forest and project planning. Do not rely solely on disturbance coefficients and TOC values when discussing existing or potential CWE impacts.

Documentation can take one of two forms. The first is a simple statement that, based on comparison of existing and potential disturbance coefficients with TOC, CWE susceptibility is not a concern requiring additional consideration in the environmental assessment process. Add to this statement a brief narrative explanation of how and why that conclusion was reached.

More extensive documentation is required when comparison of disturbance coefficients and TOC indicate that CWE is a concern. As a minimum, describe factors considered in sections 23.2 through 23.7, differences in CWE susceptibility between management alternative and recommendations for mitigation measures to reduce CWE potential.

In both situations, the narrative developed needs to answer the following types of questions:

1. What are the beneficial uses of concern?

2. Where do the important beneficial uses occur?

3. How has or might land use affect those uses?

4. What are the important climatic, physical and biological factors influencing CWE of beneficial uses?

5. How significant will downstream effects be?

6. Where will they take place?

7. Under what circumstances will they occur?

8. How long will it take the channel system and beneficial uses to recover?

24 - MONITORING AND EVALUATION. Conduct monitoring and evaluation to determine if CWE model elements are valid. Results of monitoring and evaluation will form the basis for modifying and refining evaluation techniques in the future.

Monitoring and evaluation are separate, sequential activities that provide information to determine whether CWE susceptibility modeling and evaluation are meeting their intended objectives. Monitoring collects information, on a sample basis, from specified sources. Evaluation of monitoring results is used to determine the effectiveness of CWE evaluations and the need to modify model elements. Monitoring is conducted at three distinct levels: implementation, effectiveness and validation.

24.1 - Implementation Monitoring. Conduct implementation monitoring as part of routine assignments and document the results in management files. Use implementation monitoring to determine if plans, prescriptions, projects and activities are implemented as designed and in compliance with appropriate environmental documents.

24.2 - Effectiveness Monitoring. Determine the effectiveness of CWE susceptibility analysis for reducing and maintaining the risk of adverse CWE to acceptable levels. Effectiveness monitoring determines if plans, prescriptions, projects and activities are effective in meeting management direction, objectives, and standards and guidelines. Conduct effectiveness monitoring after determining that plans, prescriptions, projects and activities have been reasonably implemented.

24.3 - Validation Monitoring. Conduct validation monitoring when effectiveness monitoring results indicate basic assumptions or coefficients are questionable. Validation monitoring determines whether the initial data, assumptions, and coefficients used in development and implementation of the model are correct or if there are better ways to meet the objectives.

25 - IMPLEMENTATION

25.1 - Organizational Structure. CWE assessments are conducted within a tiered organizational framework. This framework consists of three levels that interact and provide for continuity of application between forests, development of disturbance coefficients and other factors based on local experiences, and the latitude necessary for assessments to be sensitive to local conditions.

The three organizational levels are Regional, Sub-regional and Forest. Team composition is interdisciplinary at each level. Individuals serve on the Regional and Sub-regional teams at the request of the Regional CWE Coordinator, with approval of their line officer.

1. Regional Team. The Regional Team is administered by the Regional Office, Range and Watershed Management (RO-RWM). It provides Regional direction and assists the Sub-regions and forests in conducting CWE assessments. It also provides quality control and assures that necessary interaction occurs between the Sub-regional Groups.

The Regional CWE Coordinator, RO-RWM, and one member from each of the Sub-regional Groups comprise the Regional Team.

2. Sub-Regional Groups. The three Sub-regional Groups bring together forests having broadly similar geomorphic and climatic characteristics and experiencing similar land management activities. The purpose of each of these groups is to modify the Regional Methodology, as required, to reflect sub-regional variations and to guide implementation and monitoring within its respective Sub-region.

The Sub-regional Group is the primary support group for any individual forest requiring assistance in analyzing CWE. The Regional CWE Coordinator provides technical and administrative consultation to each of the Groups.

Exhibit 1 lists the forests that make up each of the Sub-regional groups. Some forests are in two groups because they are located in a transition zone between two adjacent groups.

EXHIBIT 1

SUB-REGIONAL GROUPS

NORTHERN	CENTRAL	SOUTHERN
Six Rivers	Plumas	Sequoia
Klamath	Tahoe	Angeles
Modoc	Eldorado	Los Padres
Shasta-Trinity	LTBMU	San Bernardino
Mendocino	Stanislaus	Cleveland
Plumas	Sierra	Inyo
Lassen	Sequoia	

3. Forests. Forest Supervisors conduct CWE assessments for both forest-wide and project planning using concepts and procedures presented in this chapter. They are responsible for actively participating in their Sub-regional Group and for incorporating refinements developed by their Sub-regional Group into forest-specific CWE assessments.

Forest Supervisors conduct CWE assessments utilizing interdisciplinary teams composed of earth scientists and other required disciplines. These teams modify Sub-regional guidance to meet local requirements. They develop and utilize necessary watershed- and site-specific information regarding beneficial uses of water, watershed characteristics, and land disturbance factors that are sensitive for use in assessing CWE during project planning.

25.2 - Wild Fire. The following guidelines were developed following field review of large watershed areas burned on the Klamath, Shasta-Trinity, Mendocino and Stanislaus National Forests in the fall of 1987.

1. Evaluations should be consistent with existing Forest Plan direction and project planning procedures and techniques for assessing CWE.

2. Use available information to assist in evaluating CWE. Burned Area Reports (FSH 2509.13, Report FS-2500-A), and supporting data contain information valuable in evaluating the impacts resulting from the burns, as modified by emergency rehabilitation measures and treatments. These reports also contain estimates of watershed recovery.

3. Objectives for protection of beneficial uses of water do not change because an area has been burned. The ability to meet the objectives may be altered and, therefore, require extra care in planning Resource Recovery Programs and in identifying and implementing special mitigation efforts.

4. In watersheds approaching or exceeding Threshold of Concern (TOC) prior to burning, management direction for Resource Recovery efforts should be consistent with any management decisions made regarding CWE mitigation before the area was burned. In situations where management decisions are significantly different, it is important that information in EAs and other documents clearly present the methods and results of CWE analyses conducted, together with the rationale for changes in management direction.

5. Most of the hillslope vegetation, organic ground cover and large organic debris in channels will be lost in areas of high burn intensity. These are the areas most susceptible to significant changes in watershed hydrology and sedimentation processes (surface erosion, landsliding and mobilization of stored sediment in stream channels, hydrophobic soils). Considerations beyond normal prescriptions are sometimes needed to mitigate adverse effects resulting from these changes.

6. Design and implement monitoring programs to evaluate the effectiveness of Resource Recovery Program (RRP) efforts in mitigating significantly adverse CWE.

7. The following steps will normally be used to evaluate CWE in watersheds that have been burned by wildfire:

a. Identify burned areas and downstream beneficial uses of water that may be adversely affected by the burns and RRP efforts.

b. Determine which watersheds to analyze. Base these determinations on burned areas, fire intensities, beneficial uses potentially at risk and other locally important factors.

In most cases, CWE analysis areas will be the same as those used for project-level CWE planning. In northwestern California, these are most often second- and third-order watersheds that typically range in size between 500 and 2,000 acres.

Some situations will also require analysis of CWE on larger watershed systems. It will be necessary to evaluate CWE for fourth- and fifth-order watersheds where an individual fire has extended across two or more second- or third-order watersheds, and when smaller fires have burned significant acreage in small, adjacent watersheds. Analysis of the larger watershed system can be done by aggregating information obtained from evaluating second- and third-order watersheds.

c. Determine pre-fire land disturbance history for each watershed and compare with the watershed's TOC. This information provides a pre-fire estimate of each watershed's susceptibility to significantly adverse CWE.

d. Evaluate current condition of burned areas. Variables to consider include burn intensity (high, moderate, low) and degree of modification of anticipated watershed impacts by implementing emergency rehabilitation treatments. High-intensity burn areas exhibit characteristics such as elimination of ground cover, loss of crown canopy, loss of riparian area vegetation, burning out of large organic material within channels, and hydrophobic soils.

Moderate- and low-intensity burn areas exhibit increasingly less severe characteristics. For example, some riparian area vegetation may remain in moderate-intensity burn areas while nearly all may be retained in low-intensity burn areas.

e. Compare current condition of burned areas with:

(1) Site disturbance impacts from timber harvesting and site prep operations in similar terrain.

(2) Known effects of previous burns in similar areas.

Use this comparison to estimate burned area disturbance coefficients.

It is recommended that only a limited number of disturbance coefficients be developed. Three disturbance levels will normally be adequate for each terrain type within any given climatic regime (rain-dominated, rain-on-snow, snow-dominated). The coefficients should correspond to varying degrees of disturbance observed in the high, moderate and low intensity burned areas.

Preliminary surveys of some burned areas suggest that disturbance coefficients for high-intensity burn areas, as modified by emergency rehabilitation measures, will be equivalent to or somewhat higher than a typical clearcut/broadcast burn operation on similar ground. In contrast, many low intensity burned areas exhibit characteristics that are very similar to adjacent unburned areas. Disturbance coefficients would be very small, or zero, in these latter situations.

f. Estimate site recovery of burned areas, as modified by emergency rehabilitation work. This information is available in Burned Area Reports.

g. Use information developed in e. and f. of this section to estimate current watershed susceptibility to CWE. Use this information in environmental assessments of Resource Recovery opportunities and limitations.

8. Conduct CWE assessments for each alternative considered during Resource Recovery program planning. Information developed in e. and f. of this section, together with prior experience working in similar areas, should guide efforts to estimate site disturbance and recovery coefficients.

Preliminary evaluation of burned areas suggests that projected impacts of harvesting high-intensity burn areas may not add significantly to the overall impacts of the burns. This is especially so in areas with existing road systems. It is also anticipated that salvage operations in these areas will result in an overall disturbance coefficient being only slightly higher than that for normal harvesting operations, provided that needed additional mitigation measures are reasonably implemented.

25.3 - Northern Sub-Region. The following is a general summary of how the northern Sub-regional Group is evaluating CWE.

25.31 - Analysis Areas. Watershed sizes generally range between 20,000 and 50,000 acres for forest planning and between 500 and 2,000 acres for project planning.

25.32 - Natural Watershed Sensitivity. Natural watershed sensitivity is first estimated, based on geomorphic and climatic factors. These initial estimates are then modified to include consideration of the beneficial uses of concern. The result is an approximation of a watershed's ability to absorb land use impacts without causing unacceptable effects to beneficial uses of water.

For forest planning, the TOC generally ranges between 12 percent and 20 percent ERA depending upon the intrinsic sensitivity of the watershed and beneficial uses of water. Exhibit 1 contains examples of TOC values used in forest planning:

EXHIBIT 1

		TOC (%ERA)	
WATERSHED SENSITIVITY:	HIGH	MODERATE	LOW
FOREST			
Shasta-Trinity	12	16	18
Klamath	13	15	16

Threshold values for second- and third-order watersheds exhibit a greater range. Work on the Mendocino and Klamath National Forests has produced TOC values of 10 percent ERA for highly sensitive watersheds.

25.33 - Land Disturbance. Based on work conducted to date, alterations in watershed hydrology are believed to be the most probable mechanism for initiating adverse CWE on aquatic habitat. Site disturbance coefficients called equivalent road acres (ERA) have been developed to track general changes in the hydrologic functioning of watersheds. Development of the coefficients is done by comparing the effect of a land use activity to that of a road in terms of altering surface runoff patterns and timing.

ERA coefficients have only been developed for roads and timber management activities; coefficients are being developed for other activities such as grazing and prescribed burns. To date the greatest amount of work has been done developing coefficients for forest planning. Exhibit 1 contains examples of coefficients used for forest planning:

EXHIBIT 1

ACTIVITY	ERA COEFFICIENT RANGE
Road Prism	0.80 - 1.0
Tractor Clear Cut	0.30 - 0.35
Cable Clear Cut	0.18 - 0.23

These coefficients take into account all timber management activities, including site preparation.

Forests have developed more refined coefficient estimates for project planning evaluations. For example, the Shasta-Trinity National Forests developed the set of ERA coefficients shown in Exhibit 2. These coefficients are modified, based on site specific analysis (Haskins, 1983):

EXHIBIT 2

LOGGING SYSTEM	SILVICULTURE	ERA COEFFICIENT RANGE
Tractor	Clearcut	0.20 - 0.30
	Overstory Removal	0.15 - 0.20
	Select	0.10 - 0.20
	Salvage	0.10
Cable	Clearcut	0.15 - 0.20
	Overstory	0.15 - 0.20
Helicopter	Clearcut	0.10
	Select	0.05

25.34 - Site Recovery. Recovery curves are divided into two major groups. The first group is used for forest planning. A 30 year, linear recovery period has generally been used in forest planning because of limitations in understanding recovery rates and the need to generalize during large area planning. Forests use other recovery curves as they deem appropriate.

Recovery curves for use in project planning constitute the second major group. There is considerably more variation in the shape and time for full recovery in this group of curves. Forest staff use professional judgement to develop curves that reflect local site conditions and operator performance in conducting the land disturbing activity.