PREDECISIONAL

CONSOLIDATION AND ZERO-DISCHARGE PLANS
Rocky Flats Plant

Task 30
of the
Zero-Offsite Water-Discharge Study
Agreement in Principle Item C.7

Prepared for:

EG&G ROCKY FLATS, INC.
Plant Engineering/
Environmental and Waste Engineering
P.O. Box 464
Golden, Colorado 80402-0464
Authorization No. 986804 (Prev. 401009)

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Prepared by:

ADVANCED SCIENCES, INC.
405 Urban Street, Suite 401
Lakewood, Colorado 80228

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CONSOLIDATION AND ZERO-DISCHARGE PLANS
Rocky Flats Plant

EXECUTIVE SUMMARY

This report has been prepared by Advanced Sciences, Inc., (ASI) for EG&G's Plant Engineering/Environmental and Waste Engineering (PE/EWE) division as one of several task studies being conducted toward development of a Zero-Offsite Water-Discharge Plan for the Rocky Flats Plant (RFP) in response to Item C.7 of the Agreement in Principle (AIP) between the U.S. Department of Energy (DOE) and the Colorado Department of Health (CDH) (DOE and State of Colorado, 1989). The DOE/CDH Agreement Item C.7 states, "Source Reduction and Zero-Discharge Study: Conduct a study of all available methods to eliminate Rocky Flats discharges to the environment including surface waters and ground water. This review should include a source reduction review." (A copy of the AIP is presented in Appendix D.)

Based upon the status of 30 subordinate task studies, several possible zero-discharge alternatives, including the no-action alternative, have been proposed. One or more of these proposed zero-discharge alternatives could constitute a zero-discharge plan depending upon the definition of zero discharge.

A number of possible definitions of the term "zero-offsite water-discharge" have been discussed. These have ranged from extremely strict (no discharge of water beyond the RFP boundaries) to relatively mild (an attempt to prevent as much contamination as is technically and economically feasible from leaving the plant boundaries). This AIP study task uses the range of the definition from strict to mild and poses the following alternatives:

(1) No-action, current method of water management at the RFP would continue;

(2) No discharge of Sewage Treatment Plant (STP) effluent, surface-water runoff from selected RFP areas, or contaminated ground water off site;

(3) No discharge of STP effluent off site, but discharge of surface-water runoff and ground water under a numeric water-quality stream standard;

(4) Discharge of all water under a water-quality stream standard;

(5) Use of Great Western Reservoir as a terminal pond with selected recycle of STP effluent, with discharges from Great Western Reservoir meeting a numeric water-quality stream standard.

Alternative 2 was divided into 2 sub-alternatives, one with a new off-channel storage reservoir (Alternative 2a) and one using the existing Great Western Reservoir as temporary storage (Alternative 2b). Likewise, Alternative 4 was divided into 3 sub-alternatives which assumed a new off-channel storage reservoir (Alternative 4a), use of the existing terminal ponds as temporary storage (Alternative 4b), and use of Great Western Reservoir as temporary storage (Alternative 4c).

The last proposed alternative, Alternative 5, is identical to the selected alternative (Option 5d) in the Rocky Flats Surface-Water Management Plan (SWMP) (EG&G, 1991b), except that the SWMP does not address the disposition of water stored in Great Western Reservoir. This AIP summary of possible zero-discharge plans addresses the disposition of water in Great Western Reservoir.

A total of 8 possible alternatives for zero discharge were addressed in this AIP study task. These 8 alternatives were evaluated and ranked. Alternative 2a was ranked as the preferred alternative based upon alternative evaluation and ranking. Alternative 2b was ranked second. Both of these alternatives are absolute zero-discharge scenarios. Alternative 3, reuse of STP effluent and treatment/discharge of surface-water runoff and ground water, was ranked as the third preferred alternative. Alternative 4a and Alternative 4c were ranked as fourth and fifth, respectively. These 2 alternatives involve treatment and discharge with no reuse along with new off-channel storage (Alternative 4a) or use of the existing terminal ponds (Alternative 4c) for temporary water storage. Alternatives 5 and 4b were ranked sixth and seventh, respectively. These alternatives

both use Great Western Reservoir as an on-channel, storage terminal storage structure. The uncertainty associated with leaving Great Western Reservoir as an on-channel structure resulted in low scores for these two alternatives. The "No-Action" Alternative was ranked last. This would be expected because of the large probability of uncontrolled releases, the high risk of the existing system, the low flexibility, the large number of Individual Hazardous Substance Sites (IHSSs) from which runoff could occur, and the low public acceptability.

The selected alternative in this AIP report, Alternative 2a, includes a new off-channel STP effluent storage reservoir which may vary between about 44 million gallons (MG) and 1,770 MG, depending upon the RFP water use population and a new off-channel storage reservoir for surface- and storm-water runoff and ground water. The new off-channel runoff and ground-water storage reservoir would vary in size from between about 960 MC and 1,380 M, depending upon the amount of reuse-water demand under future plant population scenarios.

Additional components of the selected Alternative 2a include STP upgrades, recycle of STP effluent and some runoff, reverse osmosis and mechanical evaporation, ground-water cutoff, bypass of upstream flows entering the RFP site, augmentation/replacement of surface water and tributary ground water diverted out of priority, treatment/evaporation of solar-pond interceptor trench water, and treatment/evaporation of present landfill seepage. The estimated construction cost of this selected Alternative is about $28.0 million (M). Estimated annual operation, maintenance, and replacement (OM&R) costs are about $4.2M. Annual solid-waste generation estimated for this alternative includes 430 tons per year(t/yr) of dissolved solids and 50 t/yr of sludge.

CONSOLIDATION AND ZERO-DISCHARGE PLANS
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1.0 INTRODUCTION

This report has been prepared by Advanced Sciences, Inc., (ASI) for EG&G's Plant Engineering/Environmental and Waste Engineering (PE/EWE) division as one of several task studies being conducted toward development of a Zero-Offsite Water-Discharge Plan for the Rocky Flats Plant (RFP) in response to Item C.7 of the Agreement in Principle (AIP) between the U.S. Department of Energy (DOE) and the Colorado Department of Health (CDH) (DOE and State of Colorado, 1989). The DOE/CDH Agreement Item C.7 states, "Source Reduction and Zero-Discharge Study: Conduct a study of all available methods to eliminate Rocky Flats discharges to the environment including surface waters and ground water. This review should include a source reduction review." (A copy of the AIP is presented in Appendix D.)

1.1 BACKGROUND

In response to the AIP, EG&G PE/EWE personnel compiled an Action Plan (EG&G, 1989) related to the Zero-Offsite Water-Discharge Study. After being evaluated, the contents of the Action Plan were divided into 30 subordinate tasks, one of which is this report. The Action Plan had the goal of ensuring reliable waste-water treatment, acceptable surface-water quality, and elimination of significant point and non-point surface-water discharges. Although the goal of Zero-Offsite Water Discharge is somewhat optimistic and may not be realized in absolute terms, installation of specific, recommended improvements in the existing wastewater treatment plant and of storm-runoff management controls would constitute a significant step towards meeting this goal. The EG&G proposed milestone dates for meeting the Action Plan (EG&G, 1989) are summarized below.

Zero-Discharge Action Plan Schedule

Activity/Milestone	Start Date	End Date
1. Statement of Work	11/89	12/89
2. Expert Scope Evaluation - Basic Ordering Agreement (BOA)	12/89	3/90
3. Statement of Work - Develop Study (BOA)	2/90	4/90
4. Drains Identification Study	4/89	7/90
5. Locate RCRA/Non-RCRA Hazardous Tanks	4/89	7/90
6. Hazardous Influent Potential to STP	4/89	9/90
7. Water Rights	1/90	9/90
8. Surface-Water Diversion	1/90	9/90
9. STP Capability Study for Domestic Recycle	1/90	9/90
10. Surface-Water Storage Capabilities	1/90	9/90
11. Surface-Water Evaporation/Wetlands	1/90	2/91
12. Water-Resources Management	1/90	2/91
13. Waste Generation by Proposed Treatment	10/90	4/91
14. Consolidation and Zero-Discharge Plan	10/90	6/91

1.2 PURPOSE AND SCOPE

The purpose of this AIP task study, which is one of the 30 interrelated, subordinate studies, is to consolidate the results of the other 29 tasks, define the interconnections between tasks, and propose one or more alternatives for attaining zero discharge of surface water and ground water at the RFP (Task 30, ASI, 1991n).

Descriptions of the 30 tasks currently underway or completed are presented below. The description of each study is commensurate with the status of the study schedule shown in the Action Plan. Most of the study tasks have been completed and final task reports have been issued. If a report has not been issued for a given task, delays in obtaining permits were the cause.

Summary of Task Report Status

Task No. and Description[2)]	Report Status	Date
1 - Sanitary Sewer Infiltration/Inflow and Exfiltration Study	Interim Final[3)]	12/18/90
2 & 3 - Storm Sewer Infiltration/Inflow and Exfiltration and Non-Point Source Study	Interim Final[3)]	12/18/90
4 - Water-Yield and Water-Quality Study of Walnut Creek and Woman Creek Watersheds	Final	9/18/90
5 - Rainfall/Runoff Relationships Study	Final	6/18/91
6 - Storm-Runoff Quantity for Various Design Events Study	Final	1/08/91
7 - Solar Pond Interceptor Trench System Ground-Water Management Study	Final	1/15/91
8 - Present Landfill Area Ground-Water/ Surface-Water Collection Study	Final	1/15/91
9 - Design Recurrence Intervals Study	Final	8/28/90
10 - Sanitary Treatment Plant Evaluation Study	Final	1/08/91
11 & 13 - Treated Sewage/Process Waste-water Recycle Study	Final	1/08/91
12 - Reverse Osmosis and Mechanical Evaporation Study	Final	5/21/91
14 - Surface-Water and Ground-Water Rights Study in the Vicinity of the Rocky Flats Plant	Final	5/21/91
15 - Surface-Water Evaporation Study	Final	5/07/91
16 - Water-Yield and Water-Quality Study of Other Sources Tributary to Standley Lake and Great Western Reservoir	Final	12/18/90
17 - Alternatives to Zero-Discharge Study	Final	6/11/91
18 - Report on Drain Investigations	Final	6/25/91
19 - Process-Waste Minimization Study	Final	5/28/91
20 - Raw, Domestic, and Industrial Water Pipeline Leak Detection Method Study	Final	3/26/91
21 - Temporary Water Storage Capabilities Study	Final	3/19/91
22 - Ground-Water Recharge Study	None	--[1)]
23 - Study of Water Resource Management	Final	5/28/91
24 - Bypass Upstream Flows Around the Rocky Flats Plant Study	Final	1/15/91
25 - Study of Downstream Erosion Potential	Final	6/11/91
26 - Feasibility of Ground-water Cutoff/Diversion Study	Final	5/21/91

Summary of Task Report Status - continued

Task No. and Description[2]	Report Status	Date
27 - Waste-Generation Treatment Study	Final	6/04/91
28 - Augmentation Plan for the Rocky Flats Plant	Final	6/30/91
29 - Non-Tributary Ground-Water Study	Final	5/21/91
30 - Consolidation and Zero-Discharge Plans	Interim Draft	9/28/90
	Final Draft	6/25/91
	Predecisional	7/31/91[4]

1) No date set because of delays in obtaining excavation and work permits related to field efforts (ASI, Task 22, 1990ee).
2) Adapted from (ASI, 1990a).
3) Final versions of these task reports are proposed for submittal in September 1991.
4) Extended review and comment period.

The results of the individual study tasks are not summarized in this report. The reader is encouraged to refer to the subordinate task studies and other water-management activities for more detail on areas of particular interest.

The consolidation section of this report summarizes the interconnections between the individual task studies as well as other related DOE and EG&G activities. As a basis for understanding the need for a zero-discharge plan, a summary of the current regulatory framework is summarized. The consolidation section also summarizes the approaches taken toward consolidation of task and zero-discharge plans.

The zero-discharge plans portion of this report is based upon the results of the 30 subordinate task studies. Selected definitions of zero discharge are used to formulate alternatives, including the "No-Action" Alternative. One or more of these proposed zero-discharge alternatives could constitute a zero-discharge plan, depending upon the definition of zero discharge.

A number of possible definitions of the term "zero-offsite water discharge" have been discussed. These have ranged from extremely strict (an absolute ban on any type of discharge of water beyond the RFP boundaries) to relatively mild (an attempt to prevent as much contamination as is technically and economically feasible from leaving the plant boundaries, but permitting "clean" water to leave). This AIP study-task report assesses alternatives which would accomplish zero-offsite water-discharge under a range of definitions from strict to mild.

This summary of possible zero-discharge plans addresses the following general alternatives for various degrees of zero discharge:

(1) No-action, current method of water management at the RFP would continue;

(2) No off site discharge of STP effluent, surface-water runoff from selected RFP areas, or contaminated ground water;

(3) No discharge of STP effluent off site, but discharge of surface-water runoff and ground water under a numeric water-quality stream standard;

(4) Discharge of all water under a water-quality stream standard; and

(5) Use of Great Western Reservoir as a terminal pond using selected recycle of STP effluent, with discharges from Great Western Reservoir meeting a numeric water-quality stream standard.

This last proposed alternative, Alternative 5, is identical to the selected alternative, Option 5d, in the Rocky Flats Surface Water Management Plan (SWMP) (EG&G, 1991b), except that the SWMP did not address the disposition of water stored in Great Western Reservoir. This AIP study-task addresses the disposition of water stored in Great Western Reservoir as discussed in Section 3.1.5.

2.0 CONSOLIDATION OF TASKS

2.1 REGULATORY CONSIDERATIONS

In order to understand the need for an integrated water-resources management plan aimed at minimizing off-site water discharge, the first step is to review the regulatory driving forces applicable to RFP water resources. Plutonium operations at the RFP have been curtailed since the summer of 1989 investigatory actions of the RFP (DOE, 1989) which cited alleged severe health, safety, and environmental concerns at the facility. Several intergovernmental agreements were developed in response to this situation to ensure compliance with State and Federal health, safety, and environmental laws and regulations prior to full resumption of operations at the RFP. These environmental protection requirements are summarized in Tables 1 and 2.

Environmental protection requirements may take the form of Executive Orders, statutes, and agreements. Executive Orders are the result of an executive agency's being empowered by the President to promulgate regulations. Statutes are laws enacted by the legislative branch of government (such as Congress or a state legislative assembly). A statute may empower an administrative agency, such as the EPA, to develop and promulgate regulations (Arbuckle and others, 1989). Agreements are legally-binding, special negotiations between 2 or more parties.

Environmental protection standards for DOE facilities fall into three categories:

- Those imposed by DOE directives and Executive Orders;
- Those imposed by Federal statutes, regulations, and requirements; and
- Those imposed by State and local statutes, regulations, and requirements which are applicable to DOE.

Table 1

Executive Orders and Statutes Affecting Water Management at the RFP

Atomic Energy Act (AEA) of 1954 [42 USC §§ 2011, et seq., as amended 1988 & Supp. 1990] Authorizes the conduct of atomic energy activities and requires the safe management of radiation associated with those activities.
Clean Air Act (CAA) of 1970 [42 USC §§ 7401, et seq., as amended 1977, 1990] Directs EPA to establish and enforce threshold levels for pollutants. • EPA Regulations [40 CFR Parts 50, 60, and 80, et seq.] provide guidance for compliance with CAA.
Clean Water Act (CWA) of 1977 [33 USC §§ 1251, et seq., as amended 1988] Enacted to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Requires EPA (or states with approved water quality programs) to issue National Pollutant Discharge Elimination System (NPDES) permits to reduce point-source pollution. • EPA Regulations [40 CFR Parts 100, 200, 300, 400, et seq.] provide guidance for compliance with CWA.
Colorado Hazardous Waste Act (CHWA) of 1983 [CRS §§ 25-15-101, et seq.] CDH Hazardous Materials and Waste Management Division is authorized to implement RCRA in Colorado. • CDH regulations [various sections within 6 CCR 1007-3 Parts 99-300] provide guidance for compliance with CHWA.
Colorado Radiation Control Act (CRCA) of 1989 [CRS §§ 25-11-101, et seq.] Allows CDH Radiation Control Division to offer its opinions concerning the management of radiation and its potential impacts at the RFP. Affects the ability of off-site laboratories to analyze samples collected at the RFP.

Colorado Water Quality Control Act (CWQCA) of 1973 [CRS §§ 25-8-101, et seq., as amended 1982 & Supp. 1988]

Authorizes State (CDH) to establish use classifications and water quality standards and establishes the authority to issue State versions of NPDES permits.

- CDH Regulations [5 CCR 1002-3 through 7] provide guidance for compliance with CWQCA.

Colorado Water Rights Laws of 1973 [CRS §§ 37-80-120(3) and 37-92-305(5)]

Water use is governed by doctrine of prior appropriation. The RFP may need to obtain water court approval for some surface-water and ground-water management activities if the use of the water on the stream segments flowing through the RFP is changed.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 [42 USC §§ 9601, et seq., as amended 1986]

Requires EPA, DOE, and the state government to enter into interagency agreements. Requires EPA to pursue remedial actions at all sites listed by EPA on the National Priorities List (NPL). Establishes a response program for present hazardous waste activities. Requires that all legally applicable, relevant, and appropriate requirements (ARARs) of Federal and State environmental laws be applied to remedial actions at Federal sites.

Department of Energy Organization Act (DOEOA) of 1977 [42 USC §§ 7101, et seq., as amended 1988]

Created the DOE and gave it the responsibility for assuring the incorporation of national environmental protection goals.

- Department of Energy Orders (5400.1, 5400.2A, 5400.4, 5400.5, 5480.1, 5482.1, and 5484.1) establish environmental protection requirements.

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 [42 USC §§ 11001, et seq.]

Requires Federal and local governments to prepare emergency response plans and to disclose the manufacture or use of hazardous chemicals.

- EPA Regulations [various sections of 40 CFR Part 300] provide guidance for compliance with EPCRA.

Executive Order 12088 (Federal Compliance With Pollution Control Standards) of 1978 Requires the DOE to comply with the Clean Water Act and the AEA. Also allows the DOE to request an exemption from applicable pollution control standards under certain circumstances.
Hazardous and Solid Waste Amendments (HSWA) of 1984 [within 42 USC §§ 6901, et seq.] EPA Regulations [various sections within 40 CFR Parts 200-299] provide guidance for compliance with HSWA.
National Environmental Policy Act (NEPA) of 1969 [42 USC §§ 4321, et seq., as amended 1975] Requires Federal agencies to evaluate major actions for environmental impact by performing an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). • Council on Environmental Quality (CEQ) Regulations of 1979, amended in 1986 [40 CFR Part 1500, et seq.], provide guidance for implementing NEPA.
National Oil and Hazardous Substances Pollution Contingency Plan (NCP) of 1970 [Within 33 USC §§ 1251, et seq., as amended 1977, 1978] Established reporting requirements for spills. Supplemented by CERCLA and EPCRA (Title III of SARA).
Resource Conservation and Recovery Act (RCRA) of 1976 [42 USC §§ 6901, et seq., as amended 1984] Requires cradle-to-grave management of hazardous waste and provides a regulatory program for present hazardous waste activities.
Safe Drinking Water Act (SDWA) of 1974 [42 USC §§ 300, et seq., as amended 1986] Authorizes EPA to promulgate regulations that protect drinking water supplies and sub-surface waters. • EPA Regulations [40 CFR Part 141] provide guidance for compliance with SDWA.

Superfund Amendments and Reauthorization Act (SARA) of 1986 [42 USC §§ 9607, et seq.] Extended CERCLA's application to ongoing Treatment, Storage, and Disposal Units. • EPA Regulations [various sections of 40 CFR Part 300] provide guidance for compliance with SARA.
Water Quality Act (WQA) of 1987 [codified in scattered sections of 33 USC §§ 1251, et seq.] Extends deadlines for compliance with some effluent limitations and allows some modifications of water quality limitations.

Table 2

Agreements Affecting Water Management at the RFP

Agreement in Principle (AIP) of June 28, 1989 An agreement between DOE and CDH signed after 1989 investigatory actions at the RFP. Extends a memorandum of understanding that was signed between DOE and Colorado in 1979 that initiated monitoring and assessment of terminal ponds prior to discharge. Provides for samples of surface waters and treated drinking water to be split with CDH. Provides for a zero-discharge study (**this Zero-Offsite Water-Discharge Study**).
Interagency Agreement (IAG) of January 22, 1991 An agreement between DOE, the State of Colorado, and EPA which provides guidance for control and cleanup of hazardous wastes under RCRA and CERCLA. Also provides a framework for permitting of RCRA Treatment, Storage, and Disposal Units, and is designed to promote orderly, effective investigation and cleanup of contamination at the RFP while avoiding litigation between DOE, the State of Colorado, and EPA.
NPDES Federal Facilities Compliance Agreement (NPDES FFCA) of March 25, 1991 An agreement between DOE and EPA, pursuant to Executive Order 12088 which provides for compliance with water pollution control standards and appropriate operation of the Sewage Treatment Plant. Contains a Compliance Plan for meeting CWA standards at the RFP.

Specifically, this report represents zero-offsite water-discharge studies which incorporate all of the above environmental protection standards into its focus/scope. Brief descriptions of the laws and regulations affecting Water Management at the RFP are represented in Appendix A.

2.2 INTERRELATIONSHIPS BETWEEN ZERO-OFFSITE WATER-DISCHARGE STUDIES AND OTHER WATER-MANAGEMENT STUDIES

2.2.1 Relationships Among the Zero-Offsite Water-Discharge Study Tasks

The 30 subordinate study-tasks of the Zero-Offsite Water-Discharge Study are related to each other in the sense that they provide important inputs to each other and in that the assumptions developed for one task may influence the results of another. In addition to the task-to-task interrelationships, four groupings of closely-related tasks were developed, and these should be considered together in the development of the zero-discharge plan resulting from the Zero-Offsite Water-Discharge Study. These groupings, shown in Table 3, were used in the integration of the task results described below. The groupings include the four basic components of zero discharge as related to the operation of the RFP:

- Group I - Water and Wastewater Recycle (8 tasks);
- Group II - Surface-Water and Storm-Water Runoff (11 tasks);
- Group III - Ground Water (5 tasks); and
- Group IV - Water Management (6 tasks including the Zero-Discharge Plans).

Figure 1 (found in the Figures Section of this report) summarizes the interrelationships between the Group I, Group II, Group III, and Group IV studies. Figures 2 through 5 summarize the interrelationships between the subordinate studies within each of the four groups as well as between the subordinate studies and the SWMP (EG&G, 1991b) and the Groundwater Protection and Monitoring Program Plan (GPMPP) (EG&G, 1991c).

Table 3

Zero-Offsite Water-Discharge Study Related Task Groups

Task	Description
GROUP I -- WATER AND WASTEWATER RECYCLE	
1	Sanitary Sewer Infiltration/Inflow and Exfiltration Study
10	Sewage Treatment Plant Evaluation Study
11/13	Treated Sewage/Process Wastewater Recycle Study
12	Reverse Osmosis and Mechanical Evaporation Study
18	Report on Drain Investigations
19	Process Waste Minimization Study
20	Raw, Domestic, and Industrial Water Pipeline Leak-Detection Method Study
GROUP II -- SURFACE-WATER AND STORM-WATER RUNOFF	
2/3	Storm Sewer Infiltration/Inflow and Exfiltration Study and Non-Point Source Study
4	Water-Yield and Water-Quality Study of Walnut Creek and Woman Creek Watersheds
5	Rainfall/Runoff Relationships Study
6	Storm Runoff Quantity for Various Design Events Study
9	Design Recurrence Intervals Study
15	Surface Water Evaporation Study
16	Water-Yield and Water-Quality Study of Other Sources Tributary to Standley Lake and Great Western Reservoir
21	Temporary Water Storage Capabilities Study
24	Bypass Upstream Flows Around Rocky Flats Plant Study
25	Study of Downstream Erosion Potential

Table 3 (continued)

Zero-Offsite Water-Discharge Study Related Task Groups

Task	Description
GROUP III -- GROUND WATER	
7	Solar Pond Interceptor Trench System Ground-Water Management Study
8	Present Landfill Area Ground-Water/Surface-Water Collection Study
22	Ground-Water Recharge Study
26	Feasibility of Ground-Water Cutoff/Diversion Study
29	Non-Tributary Ground-Water Study
GROUP IV -- WATER MANAGEMENT	
14	Surface-Water and Ground-Water Rights Study in the Vicinity of Rocky Flats Plant
17	Study of Alternatives to Zero Discharge
23	Study of Water Resource Management
27	Waste Generation Treatment Study
28	Augmentation Plan for Rocky Flats Plant
30	Consolidation and Zero-Discharge Plans

In general, Figures 2 through 5 show that data-gathering and information tasks (located on the left-hand side of the figures) form the bases for other tasks. Proceeding from left to right across Figures 2 through 5, the later tasks become more dependent upon previous tasks. The data and information task results formed the basis for the delineated alternatives to minimize offsite water discharge. The impacts of offsite water discharge resulted from evaluation of the alternatives.

2.2.2 Relationships to Other Water-Management Studies

Figures 2 through 5 indicate the relationship of the Rocky Flats SWMP and the GPMPP to the zero-discharge subordinate tasks and the zero-discharge plan. The SWMP (EG&G, 1991b) was used extensively to address DOE-preferred alternatives to surface-water management at the RFP. The SWMP provided surface-water management alternatives evaluated in Task 17 (ASI, 1991bb) to the zero-discharge alternatives evaluated in Task 21 (ASI, 1991p).

The GPMPP (EG&G, 1991c) was used to help address DOE concerns related to ground-water management at the RFP. While the GPMPP is concerned primarily with ground-water monitoring, it is valuable in providing the Zero-Offsite Water-Discharge Study confirmatory input data on the ground-water conditions at the RFP. The GPMPP provided guidance primarily to Task 14 (ASI, 1991u), Task 26 (ASI, 1991v), and Task 29 (ASI, 1991w).

2.3 APPROACH TO CONSOLIDATION OF TASKS AND ZERO-DISCHARGE PLANS

Task 23 (ASI, 1991y) defined an approach for assessing the many alternatives for attaining zero-discharge (depending upon the user-selected definition of zero discharge), as well as the No-Action Alternative and Option 5d as defined by EG&G (1991b). The approach to consolidating the 29 subordinate study tasks (to the extent possible based upon completeness of the tasks), as well as the results of the SWMP and GPMPP, was based upon computer Program "ZOWD," developed specifically in Task 23 for this purpose. Program ZOWD provides a logical method for information reporting from the subordinate study tasks and other water-management studies

at the RFP (ASI, Task 23, 1991y). The ZOWD program searches for combinations of alternative courses of action described in the individual Zero-Offsite Water-Discharge Studies, keeping track of assumptions and objectives, and estimating the cumulative effect of these individual actions on the overall user-defined goal of zero discharge. No claim is made that this method is all-inclusive or fool-proof. The method does, however, provide a framework which makes searching for many interactions possible. The program uses a Decision Support System (DSS) to balance the need for detailed information with the reality of the data and actions which are fraught with uncertainty, and which are dependent upon a large set of externalities over which the water-resources planners and decision-makers at the RFP have little or no control (ASI, Task 23, 1991y).

The basic computations carried out by the program are fundamentally simple so as to make the results intuitively acceptable as much as possible. The process begins with Program "COMB," which searches for all possible combinations of task alternatives and provides a pointer file for use in the main analytical program, ZOWD. Program ZOWD assists the decision-maker in stating his/her goals and objectives and then checks each combination of tasks to see which combination best meets those goals. Program ZOWD tallies the total changes in water-discharge forecast by each task by simply adding these discharges subject to the constraints of relationships to other tasks to prevent double counting of discharge reductions.

Goal Setting:

The ZOWD program begins by requiring the user to define the initial goals. It is expected that the data which are used by the program to evaluate the feasibility of the defined goals will change often. At this point, the program inquires if changes to the basic data have occurred in the areas of monitoring information, new or updated information developed as part of another task, or relevant external information such as actions or data specified in other water-management studies. Updating the information base is not done by the program; but rather, the program guides the user as to the necessary procedures. Information and data have been stored in a dBase III+ file for

access by the DSS. Modifications or additions to that computer file can be accomplished by using the dBase III+ program. Information changes to the dBase file can be updated data or even structural changes to the study-task descriptions themselves. For example, a new field may need to be added to the system to incorporate new information not previously catalogued. The Task 23 report (ASI, 1991y) includes detailed instructions for updating the computerized dBase file.

Consultation:

At this point, the program compares the demands of the goals to the constraints and opportunities of the information contained in the data base. The program then suggests one or more courses of action which best achieve the desired goals. An opportunity exists at this point to go back to an earlier stage in the process to change information or goals.

The ZOWD program uses 8 key items which were judged to adequately depict the character and results of each subordinate task or other water-management task at the RFP (ASI, Task 23, 1991y). A description of the data-input reporting dimensions may be found in a series of tables in Task 23 (ASI, 1991y). These tables contain basic water-management data and information developed by the other subordinate tasks and water-management reports. As better information and data are developed, the tables presented in Task 23 will be used as data-capture forms rather than as set data references. These can then be transferred to the computer files used by the DSS contained in computer program ZOWD. An example of the data-capture forms is attached as Appendix B of this report. Step-by-step procedures for updating and using the ZOWD data base and program are given in Appendix D of the Task 23 report (ASI, 1991y) and are not repeated herein. Following, however, is a description of the 8 key items that served as reporting dimensions in Task 23.

Item 1. **Data vs. Action**

Subordinate tasks were classified as "Data" if they were performed primarily to develop necessary data and information for input into the ZOWD program, but they do not recommend any particular action. "Action" was specified if a task was primarily intended to result in a tangible improvement in the zero-discharge goals through some recommendation for action. Goals and objectives (described below) are defined by the user of the ZOWD computer program based upon the information reported in tables similar to those in Appendix B. Note that the time-frames may change from immediate (present) to short-term (next 5 years) to long-term (greater than 5 years).

Item 2. **Technical vs. Political/Regulatory**

"Technical" was used if the information developed in a given task was totally driven by some scientific rationale for the collection of data or development of information. The term "Political/Regulatory" was applied when the driving force for a given task resulted from an evaluation of a political or regulatory action, and/or when results were dictated by such actions.

Item 3. **System Impact**

These entries describe the expected impact of the task's recommendation(s) on the aspects of the water system specified. The "Delta MGY" entry is the expected change from the base in million gallons per year. The "base case" was assumed to be defined by the operation of the RFP water-related systems in 1989 (ASI, Tasks 11/13, 1991d; Task 21, 1991p; Task 27, 1991aa). "Conf fact (%)" is a subjective confidence factor ranging from 0 to 100 percent, which is attached to the impact estimate. The confidence factor is used by the system to compute a cumulative confidence level for the efficacy of a particular plan made up of several individual task-action recommendations.

Item 4. **Financial Impact**

Any comprehensive water-management plan will need to be subjected to economic or financial analysis to assess its feasibility. The total expected cost of the final zero-discharge plan, including capital and OM&R costs, where estimated, were entered from the information given in the applicable study task reports. If the task did not recommend a direct structural improvement but recommendations could impact costs of related plan improvements (such as recommendations of other tasks), a cross-reference to impacted structural features and cost implications were indicated wherever possible.

Item 5. **Environmental Impact**

At this time, it is not possible to perform a full environmental analysis of the actions recommended in each of the study-tasks. This is more appropriately done in a formal environmental document such as the upcoming Site-Wide Environmental Impact Statement. It is important, however, to indicate in qualitative terms the overall environmental impact of the task's recommended action(s). A simple ranking scheme between 0 to 10 was used, where 0 indicates no discernible impact and a value of 10 indicates severe environmental impact. This factor may also be used as a "screening tool" to identify areas which may be impacted and the required EIS documentation that may result.

Item 6. **Input from Other Tasks**

This indicator was used to enumerate those other subordinate tasks which provide important input to a given task or which are impacted by the results of a given task.

Item 7. **Input from Water Resource Plans**

These entries come from related sections of the recent draft Rocky Flats SWMP (EG&G, 1991b) and the GPMPP (EG&G, 1991c). Where possible, direct references to other reports were made.

Item 8. **Input from Monitoring**

A code was used to identify a "Monitoring Group" with responsibility for monitoring data or actions which would affect a given task.

Monitoring Groups

Group Code	Description
DOE	U.S. Department of Energy
EMAD	Environmental Monitoring and Assessment Division, EG&G
CWAD	Clean Water Act Division, EG&G
ASI	Advanced Sciences, Inc.
CDH	Colorado Department of Health
USGS	U.S. Geological Survey
EPA	U.S. Environmental Protection Agency
PE/EWE	Plant Engineering/Environmental and Waste Engineering, EG&G
SCS	U.S. Soil Conservation Service
Broom	City of Broomfield

The DSS within Program ZOWD is a process whereby the goals of the zero-discharge may be evaluated in terms of the data and actions developed in each of the subordinate study-tasks. An important feature of the DSS is that it accepts changes, not just in terms of the goals for the zero-discharge plans, but also in terms of the information that drives the plans. The concept is iterative and interactive, leading to quasi-optimization of the zero-discharge plans.

The DSS (Programs COMB and ZOWD) is not a replacement for informed, professional judgment; it is simply an aid in the decision-making process. The FORTRAN code listings for programs COMB and ZOWD are found in Appendices A and B, respectively, of the Task 23 report (ASI, 1991y). Appendix D of the Task 23 report contains a user manual for operation of these 2 Programs.

3.0 ZERO-DISCHARGE PLANS

Based upon the results of the 2a subordinate tasks spelled out in Section 1.0, zero-discharge plans for the RFP have been prepared. The methodology defined in Section 2.3 utilizing the ZOWD program was used, along with engineering judgment, for combining the results of applicable subordinate study-tasks which would satisfy the objectives of the proposed alternatives. The 5 zero discharge alternatives presented in Section 1.2 were fully assessed in the study-tasks. The alternatives are presented again to set the stage for the discussion which follows.

(1) No-action, current method of water management at the RFP would continue;

(2) No off site discharge of STP effluent, surface-water runoff from selected RFP areas, or contaminated ground water;

(3) No discharge of STP effluent off site, but discharge of surface-water runoff and ground water under a numeric water-quality stream standard;

(4) Discharge of all water under a water-quality stream standard; and

(5) Use of Great Western Reservoir as a terminal pond with selected recycle of STP effluent, with discharges from Great Western Reservoir meeting a numeric water-quality stream standard.

The above 5 zero-discharge alternatives resulted in eight final alternatives, any one of which could meet the goals of a zero-discharge plan depending upon the final definition of zero discharge. Table 4 presents a matrix of the 8 zero-discharge alternatives in relationship to their various components. Descriptions of the 8 final zero-discharge alternatives are presented in more detail below.

3.1 ALTERNATIVE ASSESSMENTS

As a result of these 8 possible zero-discharge plans, alternative assessments of each plan were undertaken. Each assessment assumed that the time period for meeting the goal of the alternative was within the next 5 years. It did not appear appropriate to assume either an immediate time

Table 4

Zero-Discharge Alternatives and Their Various Components

Zero-Discharge Alternative Number	Description	Surface-Water and Storm-Water Runoff from 1.9 sq.mi.	Surface-Water and Storm-Water Runoff from 5.5 sq.mi.	Rehabilitate Existing Terminal Ponds A-4, B-5 and C-2	New Off-Channel Storage for Surface-Water and Storm-Water Runoff	New Off-Channel Storage for STP Effluent	Rehabilitate Great Western Reservoir as an Off-Channel Reservoir	Rehabilitate Great Western Reservoir as an On-Channel Reservoir	New On-Channel Storage	Upgrade Existing STP	Standley Lake Bypass	Great Western Resvoir Bypass	Rock Creek Bypass	Upgrade Woman Creek Bypass	Upgrade McKay Bypass	Kinnear/Smart Ditch/ Woman Creek Bypass	Upgrade South Interceptor Canal	New Runoff Collection Channels	Recycle to Industrial Water Loop	Collection/Treatment of Solar Pond Interceptor Trench System (SPITS) Water	Collection/Treatment of Landfill Leachate	Collection of Runoff From IHSS's	RO/Mechanical Evaporation	Waste Generation Treatment	Ground-Water Cutoff of Contaminant Plumes	Water Rights Augmentation
1	"No-Action"	6) ●	6) ●							8) ●		1) ●							2) ●	3) ●			4) ●	5) ●	7) ●	
2a	Absolute Zero-Discharge with New Off-Channel Storage Reservoir	●		●	●	●				●			●	●	●	●	●	●	●	●	●	●	●	●	●	●
2b	Absolute Zero-Discharge with Off-channel Great Western Reservoir	●		●		●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3	Zero-Discharge of STP Effluent with Treatment and Discharge of Surface Water and Ground Water	●		●	●	●				●			●	●	●	●	●	●	●	●	●	●	●	●	●	●
4a	Treatment and Discharge of All Water With New Off-Channel Storage Reservior	●		●	●	●				●			●	●	●	●	●	●		●	●	●	●	●	●	●
4b	Treatment and Discharge of All Water With On-Channel Great Western Reservoir		●	●				●		●			●	●	●	●	●	●		●	●	●	●	●	●	●
4c	Treatment and Discharge of All Water with Existing Terminal Ponds Storage	●		●						●			●	●	●	●	●	●		●	●	●	●	●	●	●
5	SWMP Option 5d with Treatment and Discharge From Great Western Reservoir		●	●				●	●	●	●						●	●	●			●	●			●

1) A limited capacity of approximately 1100 CFS. Bypass is presently in place.
2) Limited recycle using the 374 Evaporator Product Water is currently beingconducted.
3) SPITS goes to 374 Evaporator.
4) BLDG 374 existing Multiple Effect Evaporator.
5) BLDG 374 treats process waste water.
6) Existing Terminal Ponds collect water from 1.4 sq. mi.
7) 881 Hillside Interceptor Trench & SPITS
8) Fine Bubbler Aeration, Automatic Chlorination and Dechlorination Systems and Remote Control of Equalization Basin Flow to STP.

period (that is, within fiscal year 1992) or a long-term time period (beyond 5 years). The long-term time period was judged to have so much uncertainty in the projected operation of the RFP that it would be impossible to assess alternatives projected for longer than that. It was further assumed that each assessed alternative would be based upon maximum reduction of offsite water discharged from the RFP. Program ZOWD was used to assess which of the 8 alternatives would maximize the amount of water retained on the RFP. Total costs were used as a tie-breaker if more than one combination of alternatives suggested by Program ZOWD gave an equal reduction in offsite water discharge. For the zero-discharge alternatives assessed, the goal of the alternative is defined based upon the degree of zero discharge. For example, Alternatives 2a and 2b (no off-site discharge of STP effluent, surface-water runoff from selected RFP areas, or contaminated ground water) would have a goal of absolute zero discharge. A sample computer output from program ZOWD for alternatives 2a and 2b is given in Appendix C.

Each alternative presented below addresses a degree of zero discharge which would fulfill a possible definition of zero discharge by the CDH or the EPA. Presented with each alternative, are the goal, the water-management components for the alternative (based upon the subordinate studies), the cost of the alternatives including construction and operation, maintenance and replacement (OM&R), and an assessment of the alternative relative to environmental and institutional aspects. An alternative evaluation matrix approach, which was also used in some of the subordinate studies, is used in this Consolidation and Zero-Discharge Plans report to compare each of the alternatives in a formal framework. The alternative evaluation matrix results are presented in Section 3.3.

3.1.1 "No-Action" - Alternative 1

The goal of Alternative 1 would be to operate the water-management system at the RFP as it was operated in 1989, the base year for comparison of water discharges. Figure 6 shows the existing water conveyance and storage systems in the vicinity of the RFP. Figure 7 is a schematic of Alternative 1, the "No-Action" Alternative. The existing water-management system at the RFP

generally consists of the components shown in Figure 7 and Table 4. About 120 million gallons per year (MGY) of water are purchased from the Denver Water Board (DWB) and brought onto the RFP for domestic and industrial uses (ASI, Tasks 11/13, 1991d; Task 21, 1991p; Task 27, 1991aa). Of the 120 MGY, about 50 MGY are distributed in the industrial water system and about 70 MGY are treated and distributed in the potable water system at the RFP (ASI, Task 27, 1991aa). Of this purchased annual volume of 120 MGY, about 75 MGY, on the average, are discharged to South Walnut Creek from the STP as treated effluent (ASI, Tasks 11/13, 1991d; Task 10, 1991f). These average annual volumes are based upon the estimated 1989 plant-site population of approximately 6,300 employees. The dissolved solids load associated with the 120 MGY of water brought on site are estimated to be about 43 tons per year (t/yr) (ASI, Task 27, 1991aa). The dissolved solids load discharged off site as a result of the 75 MGY of STP treated effluent is estimated to be about 94 t/yr (ASI, Task 27, 1991aa).

Ground water (i.e., for the base year of 1989) is currently collected from the solar pond interceptor trench system (SPITS), then pumped to the solar ponds and on to the existing mechanical evaporator in Building 374. About 3.1 MGY of collected ground water were treated in this way in 1989, resulting in about 30 t/yr of dissolved solids which were converted into 60 t/yr of saltcrete. Additionally, about 1.7 MGY of leachate from the current landfill are stored and evaporated by the Landfill Pond (Figure 6). Annually, this leachate is estimated (ASI, Task 8, 1991h) to contribute about 1.7 pounds (lbs) of solvents, 0.1 lbs of polynuclear aromatic hydrocarbons, 32 lbs of oil and grease, and 6.7 tons of salts to the Landfill Pond. Surface-water runoff in the amount of about 3.5 MGY is also stored at or evaporated from the current Landfill Pond. The SWMP (EG&G, 1991b) estimates that the general ground-water flow across the RFP is on the order of 3.3 MGY.

Surface-water runoff from the RFP either is stored temporarily and evaporated in the A-, B-, and C-series ponds or is allowed to flow off site within the natural drainage system. The terminal ponds (Pond A-4, Pond B-5, and Pond C-2) (Figure 6) temporarily store and evaporate surface-water runoff from about 1.4 square miles (mi^2) of the RFP area (ASI, Task 6, 1991e; Task 21,

1991p). Part of this area is called the Controlled Area (Figure 6) and contains all of the manufacturing facilities and many of the other active operations at the RFP. For the period from June 1989 through March 1991, about 210 MG of water from the terminal ponds was treated and released downstream (ASI, Task 27, 1991aa). This 210 MG included not only surface-water runoff but also STP effluent and ground water which entered the storm-sewer and sanitary sewer systems (ASI, Task 1, 1990z; Tasks 2/3, 1990aa).

Typical long-term surface-water runoff volumes from the 1.4 mi^2 area would be expected to be only about 42 MGY (ASI, Task 21, 1991p). The dissolved solids load from this 42 MGY is estimated to be about 45 t/yr (ASI, Task 27, 1991aa). The estimated annual surface-water runoff volume of about 42 MGY is ultimately collected by the 3 terminal ponds (A-4, B-5, and C-2). Pond A-4 collects runoff from about 0.63 mi^2, which include most of the Protected Area (PA) and part of the Controlled Area (Figure 6). Pond B-5 receives runoff primarily from 0.41 mi^2 of the Lump Sum, 400-complex, and 800-complex (non-plutonium processing) parts of the Controlled Area (Figure 6). Pond C-2 receives runoff, through the South Interceptor Canal from 0.36 mi^2 of the southern part of the Controlled Area (non-plutonium areas) (Figure 6). Pond C-2 is an off-channel pond, except during floods on Woman Creek greater than the 100-year flood. Larger floods would contribute varying amounts of water to Pond C-2 (ASI, Task 24, 1991i). Previous studies (ASI, Task 9, 1990o; Task 6, 1991e; Task 21, 1991p) have shown that the 3 terminal ponds cannot completely store the runoff from the 100-year, 72-hour storm, which was the original design storm, for these facilities (McCall-Ellingson & Morrill, Inc., 1978). Both the emergency spillway crests and dam crests of the 3 terminal ponds would have to be raised to completely store the runoff from this original design storm. For the alternatives assessed below, it was assumed that the 3 terminal ponds would be improved to completely store the 100-year, 72-hour storm runoff.

Surface-water runoff from areas other than the 1.4 mi^2 basins collected by the terminal ponds is discharged off site under natural drainage conditions. Irrigation and municipal water, diverted from Coal Creek west of the RFP, is carried across the RFP Buffer Zone by the Upper Church

Ditch, McKay Bypass (Ditch), Kinnear Ditch, and Smart Ditch (Figure 6) for use off site. The Mower Ditch (Figure 6) diverts water from Woman Creek downstream from Pond C-2. None of these ditches flows through developed areas of the RFP. Previous studies (ASI, Task 4, 1990v; Task 16, 1990y; Task 14, 1991u) have inventoried and summarized the quantities of water diverted annually by these ditches over about the last 20 to 30 years. Because all of the above ditches except for the Mower Ditch divert water from Coal Creek, they would allow uncontrolled flood flows from floods greater than about the 25-year flood on Coal Creek to enter the RFP at the west boundary of the site. Historically, both North Walnut Creek and Woman Creek have received flood waters that overflowed from Coal Creek. The South Boulder Diversion Canal (Figure 6), located along the west RFP boundary, conveys water from South Boulder Creek to Ralston Reservoir and is the primary source of the RFP industrial and domestic water supply. Flood overflows from the South Boulder Diversion Canal also could impact North Walnut Creek and Woman Creek. Rock Creek (Figure 6) drains the northwest part of the RFP site. Water in Rock Creek is permitted to flow off site to the north towards the confluence with Coal Creek.

Surface-water runoff from the vicinity of the present Landfill Pond flows downstream to the confluence of this unnamed tributary with Walnut Creek (Figure 6). This water then combines with flows in Walnut Creek and discharges off site to Great Western Reservoir. Low flows, less than approximately 1,100 cubic feet per second (cfs), in Walnut Creek are bypassed around Great Western Reservoir; however, flows greater than about 1,100 cfs still enter the reservoir, because the bypass ditch capacity is inadequate to route these larger flows. The existing bypass ditch around Great Western Reservoir will not carry the 100-year, 72-hour design flood peak discharge (ASI, Task 6, 1991e). Table 5 summarizes the estimated average annual surface-water runoff and 100-year, 72-hour storm-water runoff volumes at selected locations at the RFP (Figure 6).

The net effect of the "No-Action" Alternative is that about 120 MGY of water are discharged off site each year on the average. Total dissolved solids retained on site in 1989, assumed to represent the "No-Action" Alternative, were estimated to be about 280 t/yr (ASI, Task 27, 1991aa) and resulted in over 800 tons of saltcrete, which is stored on site. In 1989, the treatment

Table 5

Annual Surface-Water and Storm-Water Runoff at Selected Locations at the Rocky Flats Plant

Location[4]	Drainage Area[1] (mi^2)	Average Annual Runoff[2]		100-yr, 72-hr Flood Runoff[3]	
		(ac-ft)	(MG)	(ac-ft)	(MG)
Pond A-4	0.63	54	18	139	45
Pond B-5	0.41	39	13	106	34
Pond C-2	0.36	35	11	71	23
Subtotals	1.40	128	42	316	102
West Spray Field	0.31	32	10	81	26
Present Landfill	0.13	16	5.2	25	8.1
Old Landfill	0.03	5.4	1.8	5.3	1.7
Subtotals	0.47	53.4	17.0	111.3	35.8
TOTALS	**1.9**	**181**	**59.0**	**427**	**138**
Off-Channel Great Western Reservoir	2.2	202	65.8	473	154
Walnut Creek at Indiana Street	2.9	178	58	790	257
Walnut Creek at Great Western Reservoir	5.5	288	93	1,200	391
Woman Creek at Indiana Street	2.8	31	10	900	293

1) ASI (Task 4, 1990v; Task 6, 1991e; Task 21, 1991p; Task 14, 1991u).
2) ASI (Task 4,1990v; Task 21, 1991p; Task 14, 1991u).
3) ASI (Task 24, 1991i; Task 6, 1991e).
4) As shown on Figure 6.

of water discharged from the existing terminal ponds resulted in about 14 t/yr of granular activated carbonand 100 cubic yards (yd^3) of filters being generated. STP sludge generated in 1989 was about 50 t/yr (ASI, Task 27, 1991aa). This solid waste has to be either stored on site or transported to an approved off-site waste storage facility.

3.1.2 Absolute Zero Discharge - Alternatives 2a and 2b

The goal of Alternative 2 would be to provide zero discharge of: STP effluent; surface-water and storm-water runoff from about 1.9 mi^2 of area, including the Controlled Area and active parts of the Buffer Zone; and about 3.9 MGY of alluvial ground water from control of contaminant plumes. The 1.9 mi^2 area was obtained by adding the drainage areas of the West Spray Field (0.31 mi^2), the Present Landfill (0.13 mi^2), and the Old Landfill (0.03 mi^2) to the 1.4 mi^2 already draining to the terminal ponds (Table 5 and Figure 6). Controlling surface-water and storm-water runoff and contaminated ground water from 1.9 mi^2 of drainage basin area at the RFP results in collection of water from all but five of the approximately 178 IHSSs currently identified at the RFP (ASI, Task 21, 1991p).

Alternative 2 was divided into two sub-alternatives which depend upon the type of temporary water storage used for each alternative. A summary of system components for Alternatives 2a and 2b are presented in Table 4. Alternative 2a uses a new off-channel reservoir to temporarily store surface-water runoff for reuse (Figure 8 and Table 4). Alternative 2b uses the existing Great Western Reservoir as an off-channel reservoir to temporarily store surface-water runoff for reuse (Figure 9 and Table 4). Except for this difference, the remainder of the components of Alternatives 2a and 2b are the same.

The components of Alternatives 2a and 2b include a separate, temporary, off-channel storage reservoir for STP effluent. Depending upon the assumed population or the volume of effluent recycled on site at the RFP (varying from 3,000 to 9,000 personnel), the size of this new STP effluent storage facility may vary. Assuming a plant population of 3,000 and 100 percent

recycle, a 44 MG capacity STP effluent storage facility would be required (ASI, Task 21, 1991p). In contrast, assuming a plant population of 9,000 and no recycle, a 1,770 MG capacity STP effluent storage facility would be required (ASI, Task 21, 1991p). Studies related to recycle of STP effluent (ASI, Tasks 11/13, 1991d) indicate that all of the STP effluent generated under all population scenarios (except shutdown) could be reused in the industrial water system at the RFP.

It was also estimated that additional industrial water would be needed over and above the STP effluent recycle volumes (ASI, Tasks 11/13, 1991d). This additional water would come from surface-water runoff and ground water. These additional water volumes were estimated to range from 1.5 MGY to 46 MGY (except for the shutdown case where minimal recycle water would be needed) (ASI, Tasks 11/13, 1991d). The result of recycling STP effluent and surface-water runoff/ground water into the industrial water system at the RFP would mean that less raw water would have to be purchased from the DWB. The reduction in DWB raw water purchases would be about 55 MGY. The reduction in DWB water purchases also would reduce the dissolved solids loads brought on site by about 19 t/yr (ASI, Tasks 11/13, 1991d).

The components of Alternative 2a also include a new off-channel reservoir to store surface-water runoff, storm-water runoff, and contaminated ground water (Figure 8). Surface-water runoff from the 1.9 mi^2 drainage area used for Alternative 2a based upon 50 years of synthetic monthly values (ASI, Task 21, 1991p), is estimated to average about 59 MGY (Table 5). Storm-water runoff from the 100-year, 72-hour rainfall for the 1.9 mi^2 area is estimated to be about 138 MG (Table 5). The existing terminal ponds would be used to collect surface-water and storm-water runoff with immediate pumping to the proposed off-channel storage reservoir. Contaminated ground water would be pumped directly to the off-channel storage reservoir. The size of the new off-channel storage reservoir is estimated to be between about 960 MG to 1,380 MG, depending upon the amount of reuse water demand under future plant population scenarios.

In Alternative 2b, an off-channel Great Western Reservoir would be used to store surface-water runoff, (estimated to be about 65.8 MGY), storm-water runoff (estimated to be about 154 MG),

and contaminated ground water (estimated to be about 3.9 MGY). The drainage area contributing to an off-channel Great Western Reservoir is about 2.2 mi^2 (Table 5). Great Western Reservoir would be considered to be off-channel because a bypass channel, desi3gned to pass at least the runoff from the 500-year, 72-hour storm, would be constructed from about Indiana Street around the Reservoir (Figure 9). The 2.2 mi^2 drainage basin includes 1.9 mi^2 at the existing terminal ponds plus about 0.3 mi^2 in the vicinity of Great Western Reservoir downstream from the bypass channel.

Additional components of Alternatives 2a and 2b would consist of diversion of the surface-water runoff in the vicinity of the Present Landfill, West Spray Field, and Old Landfill (Figure 6) into the existing terminal ponds for immediate transport to either the new off-channel storage reservoir or Great Western Reservoir (ASI, Task 21, 1991p). STP upgrades (ASI, Task 10, 1991f), recycle of STP effluent (ASI, Tasks 11/13, 1991d), reverse osmosis and mechanical evaporation (ASI, Task 12, 1991x), ground-water cutoff (ASI, Task 26, 1991v), treatment/evaporation of solar-pond interceptor trench water (ASI, Task 7, 1991j), and treatment/evaporation of present landfill seepage (ASI, Task 8, 1991h) also are components of Alternatives 2a and 2b (Figures 8 and 9). In order to minimize the potential for surface-water and storm-water runoff to enter the RFP site from upstream, these storm-water flows are proposed to be bypassed around the RFP using a bypass system (ASI, Task 24, 1991i). This bypass system would route up to the 500-year flood flows entering the upper Walnut Creek system from Coal Creek and the natural Upper Walnut Creek drainage basin to Rock Creek (Figures 6, 8 and 9), as well as bypassing these same flows from upper Woman Creek south to an unnamed gulch along the south RFP boundary (Figures 6, 8 and 9). In both cases, the bypassed water is returned to the same drainage basins from which it originated, but downstream from the RFP site. This would help reduce the potential for contamination of off-site water and reduce the volumes of water which would have to be handled/treated under this zero-discharge alternative.

Because both surface water and tributary ground water would be diverted out of priority as part of Alternatives 2a and 2b, depletions to the streams as a result of diverting this water would have

to be replaced to meet on-site usage demand. The estimated average annual quantity of augmentation or replacement water is about 154 MGY for Alternatives 2a and about 172 MGY for Alternative 2b (ASI, Task 28, 1991ff).

The net effect of these alternatives (absolute zero-discharge) is that between about 138 MGY and 145 MGY of water would be retained on site and either reused, evaporated, or stored. The resulting dissolved solids generation from treatment of water for this alternative is estimated to be about 440 t/yr (ASI, Task 27, 1991aa). Sludge generated from the STP would remain at about 50 t/yr, but would depend upon the population assumed at RFP. Because no water would be treated for off-site discharge, no granular activated carbon and filters would be required under Alternatives 2a and 2b.

3.1.3 Zero Discharge of STP Effluent, with Treatment/Discharge of Surface Water and Ground Water - Alternative 3

The goal of this alternative would be to minimize off-site discharge of contaminants in surface water and ground water, with zero discharge of STP effluent only. Figure 10 is a schematic of this alternative and Table 4 presents a summary of system components for this alternative. The components of Alternative 3 are similar to those of Alternative 2a, except that water which is not recycled is proposed to be: treated by an advanced water treatment plant to meet existing numeric stream standards (CWQCC, 1989; ASI, Tasks 2/3, 1990aa; EG&G, 1991b), released as surface water, and discharged off site. As in Alternatives 2a and 2b, STP effluent would be stored in a separate new off-channel pond providing a storage capacity of between 44 MG and 1,770 MG. Surface-water runoff and storm-water runoff would be captured in the existing terminal ponds and immediately pumped to the proposed off-channel reservoir. Contaminated ground water would be pumped directly to the off-channel storage and advanced water treatment system. The estimated capacity of this storage reservoir would range from about 106 MG to 750 MG, depending upon the amount of additional recycle water demand at the RFP (ASI, Task 21, 1991p; Task 17, 1991bb).

STP upgrades (ASI, Task 10, 1991f), recycle of STP effluent (ASI, Tasks 11/13, 1991d), reverse osmosis and mechanical evaporation (ASI, Task 12, 1991x), ground-water cutoff (ASI, Task 26, 1991v), treatment/evaporation of solar-pond interceptor trench seepage (ASI, Task 7, 1991j) and present landfill seepage (ASI, Task 8, 1991h), and bypass of upstream flows (ASI, Task 24, 1991i) also comprise proposed components of Alternative 3 (Figure 10). Because both surface water and tributary ground water would be diverted out of priority as part of Alternative 3, depletions to the streams, as a result of diverting this water, would have to be replaced. The estimated average annual quantity of augmentation or replacement water is about 154 MGY for this alternative (ASI, Task 28, 1991ff).

The net effect of Alternative 3 would be that about 13 MGY of water would be stored on site and either reused or evaporated and about 97 MGY of water would be treated and discharged downstream. Dissolved solids removed from water at the RFP and retained on site for this alternative would increase from the "No-Action" Alternative of about 280 t/yr to about 380 t/yr. STP sludge generation would be about 50 t/yr and granular activated carbon for treatment of water discharged off site would be about 12 t/yr. Filter material used in the advanced water treatment process would be about 80 yd^3/yr.

3.1.4 Treatment and Discharge of All Water - Alternatives 4a, 4b, and 4c

The goal of Alternative 4 would be to meet currently applicable CDH numeric stream standards by treating STP effluent, surface-water and storm-water runoff, and contaminated ground water and discharging it off site. Alternative 4 has been divided into three sub-alternatives related to whether the temporary water storage, necessary to operate an advanced water treatment plant, is provided by a new off-channel storage reservoir (Alternative 4a), by an on-channel Great Western Reservoir (Alternative 4b), or by upgrading the existing terminal ponds (Alternative 4c). As with Alternatives 2a, 2b, and 3, Alternative 4a would still have a separate STP effluent storage reservoir to add flexibility to the treatment system. Schematics of Alternatives 4a, 4b, and 4c are shown on Figures 11 through 13, respectively, and Table 4 presents a summary of system

components. The primary difference between Alternatives 4a, 4b and 4c and Alternatives 2a, 2b and 3 is that there would be no recycle of STP effluent, surface-water runoff, storm-water runoff, or contaminated ground water. All water would be treated to currently applicable CDH numeric stream standards prior to release downstream.

For the new off-channel storage reservoir (Alternative 4a), it is estimated that storage volume for surface and ground water may range between about 100 MG and 230 MG, depending upon the size of the RFP population which would be contributing STP effluent (ASI, Task 17, 1991bb). For an on-channel Great Western Reservoir (Alternative 4b), the quantity of surface-water runoff and storm-water runoff would remain the same as it presently is for the existing on-channel reservoir. Water storage volumes contained in an on-channel Great Western Reservoir are estimated (for the 5.5 mi^2 drainage basin) to be about 93 MGY for surface-water runoff and about 391 MG for storm-water runoff from the 100-year, 72-hour storm (Table 5). These water volumes are much larger than those which would be treated in Alternatives 4a and 4c. For the upgraded existing terminal ponds (Alternative 4c), it is estimated their storage capabilities would have to be increased from their present 80 MG to about 140 MG (ASI, Task 21, 1991p).

Other components common to Alternatives 4a, 4b, and 4c would be the same as those for Alternatives 2a, 2b, and 3, including STP upgrades, reverse osmosis and mechanical evaporation, treatment and evaporation of solar-pond interceptor trench and present landfill seepage, contaminated ground-water cutoff, and bypass of upstream flows. Both surface water and tributary ground water would be diverted out of priority as part of Alternatives 4a, 4b, and 4c. Depletions to the streams as a result of diverting this water would have to be replaced. The estimated average annual quantity of augmentation or replacement water is about 79 MGY for Alternatives 4a and 4c, and about 125 MGY for Alternative 4b (ASI, Task 28, 1991ff).

The net effect of Alternatives 4a, 4b, and 4c would be that about 138 MGY of treated water would be discharged from the RFP for Alternatives 4a and 4c; whereas, about 172 MGY of treated water would be discharged under Alternative 4b, because more water would have to be

treated at Great Western Reservoir due to the increased drainage area at that location. Dissolved solids resulting from water treatment at the RFP would range from 380 to 420 t/yr. STP sludge generation would be about 50 t/yr. Granular activated carbon volumes would range from about 35 to 50 t/yr and filter material volumes would range from 240 to 340 yd^3/yr (Task 27, ASI, 1991aa).

3.1.5 SWMP Option 5d with Advanced Water Treatment and Discharge from Great Western Reservoir - Alternative 5

The goal of Alternative 5 would be to minimize off-site discharge of STP effluent by recycle and control of surface-water runoff and storm-water runoff. This alternative is identical to Option 5d in the SWMP (EG&G, 1991b) except it has been assumed that the advanced water treatment plant, originally proposed by the SWMP (EG&G, 1991b) at Pond A-4, would be moved to Great Western Reservoir in order to make this alternative viable. Figure 14 is a schematic of Alternative 5, and system components are presented in Table 4. The SWMP (EG&G, 1991b, p. C-131) states the "Disposition of stored water [in Great Western Reservoir] has not been addressed." The selected alternative in the SWMP (Option 5d) also is referred to as Option B/J by the Skaggs' Committee. Alternative 5 proposes to convert Great Western Reservoir into a terminal detention storage facility for final water management of drainage and flood control for Woman Creek and Walnut Creek. For purposes of the 5 Alternatives for zero-discharge plans in this AIP report, the advanced water treatment plant was moved to Great Western Reservoir, because previous studies (ASI, Task 6, 1991e; Task 21, 1991p) have shown that without discharge, Great Western Reservoir could not store all of the surface-water and storm-water runoff imposed under Alternative 5.

The SWMP (EG&G, 1991b) estimated that "critical year" inflow to Great Western Reservoir from surface-water runoff, storm-water runoff, and ground water would be about 226 MG. For purposes of this report, a critical year is one in which a 100-year flood occurs in addition to normal annual surface-water runoff and ground-water flow. However, the SWMP assumes that

the drainage area generating this runoff is only about 4 mi^2. Because no diversion is proposed to make Great Western Reservoir off-channel, it is judged that the drainage area discharging to it is actually about 5.5 mi^2, which could generate about 484 MG in surface-water and storm-water runoff in a critical year (Table 5 and Figure 6). In addition, runoff from the Woman Creek drainage basin at Indiana Street also is proposed to be pumped into Great Western Reservoir (Figure 14). The drainage area of Woman Creek at Indiana Street is about 2.8 mi^2, which is estimated to generate about 303 MG of surface-water and storm-water runoff during a critical year (Table 5). Therefore, it appears that unless water is discharged from Great Western Reservoir, it would fill to overflowing in the long-term based upon reservoir operational studies (ASI, Task 21, 1991p).

Components of Alternative 5, based upon the SWMP (EG&G, 1991b), include an on-channel Great Western Reservoir without enlargement (storage capacity of about 1,060 MG), a 100-year event storage reservoir (capacity about 179 MG) on Woman Creek, pump and pipeline from the new Woman Creek Reservoir to Great Western Reservoir, a 100-year flood-flow bypass canal around Standley Lake, a new Kinnear Ditch bypass pipeline, extension of the South Interceptor Canal to the east, and a seepage pumpback system at the toe of Great Western Reservoir (Figure 14).

The recycle part of Alternative 5, as proposed in the SWMP, is somewhat different from that proposed in Alternatives 2a, 2b, and 3 (Figures 8 through 10). Pond C-2 recycle (Figure 14) involves the construction of 8,300 ft of 8-inch diameter pipeline from Pond C-2 to the industrial water system of the RFP. A floating intake would be used at Pond C-2 for treatment filtration to remove suspended solids prior to pumping to the RFP. Two 25,000 gal surge tanks also would be included (EG&G, 1991b).

The recycle system for STP effluent would consist of reverse-osmosis facilities, a lined evaporation pond for blowdown water, sludge management facilities, building improvements, and non-potable water distribution facilities. Water from Pond B-5 would be discharged to Pond A-4

(Figure 14) through an 18-inch diameter gravity pipeline. For purposes of Alternative 5 in this report, the advanced water treatment plant, originally proposed in the SWMP to be located at Pond A-4, would be relocated to Great Western Reservoir. This advanced water treatment plant would consist of chemical mixing, flocculation/sedimentation, multimedia filtration, and two-stage granular activated-carbon filtration to treat water to stream standards prior to discharge to Walnut Creek downstream from Great Western Reservoir. Both surface water and tributary ground water would be diverted out of priority as part of Alternative 5. Depletions to the streams as a result of diverting this water would have to be replaced. The estimated average annual quantity of augmentation or replacement water is about 169 MGY for Alternative 5 (EG&G, 1991b).

The net effect of Alternative 5 would be that about 29 MGY of water would be discharged off site; whereas, about 150 MGY would remain on site and be consumed, evaporated, or stored. The resulting solid-waste volumes for this alternative would include 430 t/yr of dissolved solids, 50 t/yr of STP sludge, 8 t/yr of granular activated carbon, and 50 yd^3/yr of generated filter material (ASI, Task 27, 1991aa).

3.2 DISCUSSION

Table 6 is a summary of the off-site water discharge, construction and annual OM&R costs, and solid waste generation for the 8 zero-discharge alternatives. In Table 6, the "No-Action" Alternative is assumed to be the current conditions at the RFP and represent the water and solids volumes as they were during the 1989 calendar year. The 1990 calendar year water and solids volumes were similar to the 1989 volumes.

Comparison of Alternatives 2a through 5 for selected alternatives of zero discharge with the "No-Action" Alternative (Alternative 1) gives the net change in water and solids volumes as a result of the degree of zero discharge selected. For comparison of the alternatives, it was assumed that the quantity of STP effluent would remain constant at 1989 levels (about 75 MGY). However, a smaller or larger work force at the RFP would result in a change at a rate of about 35 gallons

Table 6

Summary of Off-Site Water Discharge; Construction and Annual Operation, Maintenance and Replacement Costs; and Solid Waste Generation for Zero-Discharge Alternatives

ZERO-DISCHARGE PLAN ALTERNATIVES		ZERO-DISCHARGE PLAN COMPONENT																					TOTALS			SOLID WASTE GENERATION			
		Off/On-Channel Storage and AWT			STP Upgrades and Water Recycle			R/O and Mechanical Evaporation			Bypass Flows			Ground-Water Cutoff/Diversion			Waste Generation Treatment			Water Rights Augmentation									
		Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs 1) ($M)	Annual Costs ($M)	Offsite Water (MGY)	Constr. Costs ($M)	Annual Costs ($M)	Dissolved Solids (t/yr)	Sludge (t/yr)	Gran. Act. Carbon (t/yr)	Filters (yd^3/yr)
1. No Action		42.0	0.0	6.0	75	0.0	--	0.0	0.0	0.0	--	0.0	0.0	3.3	0.0	0.0	--	0.0	0.0	0	0.0	0.0	120.3	0.0	6.0	280	50	14	100
2. Absolute Zero Discharge (2a – New Off-Channel Storage)	2a	-59.0	12.8	1.9	-75	4.3	0.6	--	1.5	0.2	--	8.2	1.2	-3.9	1.1	0.2	--	0.1	0.0	154	0.0	0.1	-137.9	28.0	4.2	430	50	0	0
(2b – Off-Channel GWR Storage)	2b	-65.8	91.1	13.7	-75	4.3	0.6	--	1.5	0.2	--	8.2	1.2	-3.9	1.1	0.2	--	0.1	0.0	172	0.0	0.1	-144.7	106.3	16.0	440	50	0	0
3. Zero Discharge of STP Effluent Treatment and Discharge of Surface Water and Ground Water		59.0	16.3	2.4	-75	4.3	0.6	--	1.5	0.2	--	8.2	1.2	3.9	1.1	0.2	--	0.4	0.1	154	0.0	0.1	-13.1	31.8	4.8	380	50	12	80
4. Treat and Discharge All Water (4a – New Off-Channel Storage)	4a	59.0	12.5	1.9	75	2.6	0.4	--	1.5	0.2	--	8.2	1.2	3.9	1.1	0.2	--	3.9	0.6	79	0.0	0.1	137.9	29.8	4.6	380	50	35	240
(4b – Great Western Reservoir Storage)	4b	93.0	98.0	14.7	75	2.6	0.4	--	1.5	0.2	--	8.2	1.2	3.9	1.1	0.2	--	5.2	0.8	125	0.0	0.1	171.9	116.6	17.6	420	50	50	340
(4c – Terminal Ponds Storage)	4c	59.0	13.9	2.1	75	2.6	0.4	--	1.5	0.2	--	8.2	1.2	3.9	1.1	0.2	--	3.9	0.6	79	0.0	0.1	137.9	31.2	4.8	380	50	35	240
5. SWMP Option 5d with Treatment and Discharge From Great Western Reservoir		101.0	101.0	15.2	-75	42.9	6.4	--	1.5	0.2	--	16.2	2.4	3.3	0.0	0.0	--	6.3	0.9	169	0.0	0.1	29.3	167.9	25.2	430	50	8	50

Note: Negative entries indicate that water is not leaving the component and is reused or stored.

1) Assumed to be zero because leasing water from an existing water right is preferred over other alternative augmentation water sources (ASI, 1991ff).

per capita per day (GPCD) or about 0.013 million gallons per capita per year (MGCY). Many of the alternatives considered in the subordinate studies assumed that the RFP population might vary from 3,000 people to 9,000 people, with about 6,300 people establishing the 1989 calendar-year average. The alternatives presented in Table 6 have used an average RFP population of 6,300 people.

Absolute zero discharge (Alternatives 2a and 2b) is the most stringent interpretation of the stated goal. These Alternatives assume that either a new off-channel storage reservoir (Alternative 2a) or an off-channel Great Western Reservoir (Alternative 2b) would be used to store surface-water and storm-water runoff and ground water for reuse and evaporation. Both Alternatives 2a and 2b also assume the STP effluent is stored in a separate off-channel reservoir. The construction costs for these alternatives range from $28.0 million (M) for Alternative 2a to about $106M for Alternative 2b. This large construction cost differential would result because of the estimated costs for the rehabilitation of Great Western Reservoir to bring it into compliance with State of Colorado dam-safety standards (ASI, Task 6, 1991e; Task 21, 1991p; EG&G, 1991b). Annual OM&R costs are estimated to be about 15 percent of the construction costs, or about $4.2M for Alternative 2a and $16.0M for Alternative 2b. Solid-waste generation volumes are nearly the same for both Alternatives 2a and 2b (Table 6).

Alternative 3 assumed that STP effluent would be completely recycled with some of the captured surface-water and storm-water runoff and ground water used as makeup water for the deficiency in STP effluent volumes (ASI, Tasks 11/13, 1991d; Task 21, 1991p). The remaining surface-water and storm-water runoff and ground water would be treated to meet stream standards prior to release downstream. The construction costs for Alternative 3 would be about $32M, with an annual OM&R cost of about $4.8M. Solid-waste generation would be larger than the "No-Action" Alternative (Alternative 1) and the absolute zero-discharge alternatives (Alternatives 2a and 2b) (Table 6).

Alternative 4 assumes that STP effluent, surface-water and storm-water runoff, and contaminated ground water would be treated to currently applicable CDH stream standards and discharged off site. The results would be treatment of large quantities of water, but retention of small quantities of water in storage on site. Alternative 4 has three sub-alternatives which depend upon temporary water storage in either a new off-channel reservoir (Alternative 4a), in Great Western Reservoir (Alternative 4b), or in the existing, rehabilitated terminal ponds (Ponds A-4, B-5 and C-2) (Alternative 4c). The construction costs for these three alternatives are $29.8M, $116.6M and $31.2M for Alternative 4a, 4b, and 4c, respectively, and annual OM&R costs for the three sub-alternatives are $17.6M, $4.8M and $25.2M, respectively (Table 6).

Alternative 5 assumes that only STP effluent would be recycled and that Great Western Reservoir would become a terminal pond. For purposes of this study, it has been assumed that the advanced water treatment plant, originally proposed by the SWMP (EG&G, 1991b) at Pond A-4, would be moved to Great Western Reservoir in order to make this alternative viable. The estimated construction cost of Alternative 5 is about $168M, with annual OM&R costs estimated to be about $25M (EG&G, 1991b).

3.3 ALTERNATIVE EVALUATION

An alternative-evaluation system was used to rank the capabilities of each of the proposed zero-discharge alternatives. Within the alternative evaluation system are weighting factors that influence the overall zero-discharge study. The evaluation and weighting factors were selected by a committee consisting of cognizant DOE and EG&G personnel. A weighting factor of "5" means that a particular evaluation factor is not as important as one having a weighting factor of "10." Generally, the higher weighting factors were assigned to environmental-related evaluation factors.

The score given to each evaluation factor for each alternative ranged from "1" to "5." The weighted score for each evaluation factor was calculated by multiplying the weighting factor by

the score. For each alternative, the total weighted score was calculated as the sum of the weighted score for each evaluation factor. A discussion of how each of the evaluation factors was scored is as follows:

Controlled Discharge - Each alternative was sized to a maximum size allowable which, in the case of the terminal ponds, has been restricted by the surrounding topography. If an uncontrolled discharge would occur from a storage structure, a score of "1" was given to that alternative. If uncontrolled discharges would not occur within an alternative, a score of "5" was given to that alternative.

Waste Generation - Alternatives that are designed to reuse water for industrial use and those designed to treat and release water downstream would generate solid wastes during treatment. Several alternatives would be treating various amounts of water and, thus, creating various amounts of solid waste. The alternatives were ranked based upon the amount of solid waste that would be generated on an annual basis as shown in Table 6. The alternative which generates the greatest amount of solid waste was given the lowest relative score.

Risk - Each alternative presents a different level of risk associated with the possibility of failure and uncontrolled release of contaminants into the environment. Because each alternative would be designed and constructed using state-of-the-art engineering techniques, the only variable between the alternatives was whether a given storage structure would be on-channel or off-channel. A score of "1" was given to those alternatives that would have on-channel storage, and a score of "5" was given to those alternatives that would have off-channel storage.

Cost - Each alternative was ranked on the relative cost of construction of the individual components, such as reservoir storage, bypass channels, treatment facilities, pumps, piping, and annual OM&R costs as shown in Table 6. The alternative with the highest construction and annual OM&R costs received the lowest score. Costs related to generated solid-waste treatment, storage, and disposal were not included in this analysis. Costs associated with the rehabilitation

of Great Western Reservoir were included only if Great Western Reservoir was part of the alternative being assessed. In addition, costs currently being incurred for improvements at the RFP have not been included in the costs estimates.

Design and Construction Schedule - The amount of design and construction required for each alternative is reflective of the cost of each alternative. Thus, the score that was given to the design and construction schedule was the same score that is given to the cost of the alternative. Hence, the alternative with the least amount of design and construction required would receive the highest score.

Flexibility - The flexibility of any proposed zero-discharge system would depend upon the system's capability to operate under a large range of conditions. For example, the use of multiple ponds would be considered more flexible because of the ability to move the water from one pond to another. If mechanical failure were to occur within a given system, other systems could continue to operate. Most of the alternatives have been evaluated based upon the construction of single- rather than multiple- or redundant-systems. The flexibility of the single-system alternatives can be increased by constructing multiple systems. A score of "1" was given to the alternatives in which only one system are considered. A score of "5" is en to the alternatives in which multiple systems were considered.

Water Rights - The alternatives were scored in this category based upon whether or not the downstream water rights would be met by downstream release. Those alternatives in which it would be necessary to provide augmentation water to meet downstream water rights were given a lower score than those where augmentation water was not required.

Air Emissions - Alternatives which represent an advantage under this category are those which have the least volume of water to be treated for off-site release. Air emissions generally would not be an issue; however, each alternative has been given a score ranging from "1" to "5."

Wetlands/Threatened & Endangered Species (T&E) - In the event that wetlands would be created, DOE may be obligated to maintain those wetlands throughout the period of operation and beyond. For this reason, it was not considered to be a positive factor for any given alternative to create wetlands. The creation of wetlands also may cause additional long-term costs to maintain such wetlands. For example, during dry years, water may need to be purchased to maintain the newly created wetlands. Thus, the alternative which would create the least, or smallest, areal wetlands received the highest score.

IHSS - The creation of temporary water storage facilities on site may also create additional IHSSs. The alternative that would create the largest IHSS was given the lowest score. In addition, the number of existing IHSSs impacted during construction of proposed alternatives would result in a lower score than the higher number of IHSSs impacted.

Public Acceptability - Public acceptability was based upon 3 of the above evaluation factors: (1) controlled discharge; (2) risk; and (3) IHSS disturbances. These 3 evaluation factors are likely the most critical areas about which the public would be concerned. Thus, the scores that were given to the above 3 factors for each alternative were averaged to provide the score for public acceptability.

Preliminary conceptual-level cost estimates were made on the earthwork required for dam construction and/or improvements, advanced water treatment for water-rights releases downstream at the prevailing stream standards, piping and pumping for makeup-water recycle, and the other components for each alternative. The costs developed are planning-level costs only and were derived from several sources. The "average bid price" as presented in "Bids Tabs Database" from the Urban Drainage and Flood Control District (1990), the SWMP (EG&G, 1991b), and previous subordinate study task costs was used as a basis for these costs. Additionally, engineering judgments related to construction and OM&R costs also were used. Annual OM&R costs were assumed to be about 15 percent of the total estimated preliminary construction costs

based upon engineering judgment. Unlike the one-time construction costs, OM&R costs are incurred each year of the project's life.

Table 7 summarizes the alternative evaluation and ranking for the zero-discharge alternatives. Alternative 2a was ranked as the preferred alternative, based upon the alternative evaluation and ranking indicated in Table 7. Alternative 2b was ranked second. Both of these alternatives are absolute zero-discharge alternatives. Alternative 3, reuse of STP effluent and treatment and discharge of surface-water runoff and ground-water, was ranked as the third preferred alternative. Alternative 4a and Alternative 4c were ranked as fourth and fifth, respectively. These alternatives are both treatment and discharge with no reuse and involve new off-channel storage (Alternative 4a) or use of the existing terminal ponds (Alternative 4c) for temporary water storage. Alternatives 5 and 4b were ranked sixth and seventh, respectively. These alternatives both use Great Western Reservoir as an on-channel, storage terminal storage structure. The uncertainty associated with leaving Great Western Reservoir as an on-channel structure results in the relatively low scores for these latter 2 alternatives. The "No-Action" Alternative is ranked last. This would be expected, because of the large probability of uncontrolled releases, the high risk of the existing system, the low flexibility, the large number of IHSSs from which runoff could occur, and the perceived low degree of public acceptability.

TABLE 7

Alternative Evaluation and Ranking of Zero-Discharge Alternatives

EVALUATION FACTORS	WEIGHTING FACTOR	ALT 1 "No-Action"		ALT 2a Absolute Zero New Off-Channel		ALT 2b Absolute Zero Off-Channel Great Western	
		S	W	S	W	S	W
CONTROLLED DISCHARGE	10	1	10	5	50	5	50
WASTE GENERATION	7	5	35	4	28	4	28
RISK	8	1	8	5	40	5	40
COST	6	5	30	4	24	2	12
DESIGN AND CONSTRUCTION SCHEDULE	6	5	30	4	24	2	12
FLEXIBILITY	8	1	8	5	40	2	16
WATER RIGHTS	5	5	25	2	10	2	10
AIR EMISSIONS	10	5	50	4	40	4	40
WETLANDS/T&E	10	1	10	5	50	5	50
IHSS	10	1	10	2	20	3	30
PUBLIC ACCEPTABILITY	8	1.0	8	4.0	32	4.3	34
TOTALS			224		358		322
RANK			8		1		2

S = Score W = Weighted Score

TABLE 7 (Con't.)

Alternative Evaluation and Ranking of Zero-Discharge Alternatives

EVALUATION FACTORS	WEIGHTING FACTOR	ALT 3 New Off-Channel SW/GW Treat/Release Recycle STP		ALT 4a Treat/Release All New Off-Channel		ALT 4b Treat/Release All On-Channel Great Western	
		S	W	S	W	S	W
CONTROLLED DISCHARGE	10	4	40	5	50	5	50
WASTE GENERATION	7	3	21	2	14	2	14
RISK	8	4	32	5	40	2	16
COST	6	3	18	4	24	2	12
DESIGN AND CONSTRUCTION SCHEDULE	6	3	18	4	24	2	12
FLEXIBILITY	8	4	32	5	40	2	16
WATER RIGHTS	5	3	15	5	25	5	25
AIR EMISSIONS	10	3	30	2	20	2	20
WETLANDS/T&E	10	4	40	2	20	2	20
IHSS	10	4	40	2	20	3	30
PUBLIC ACCEPTABILITY	8	4.0	32	4.0	32	3.3	26
TOTALS			318		309		241
RANK			3		4		7

TABLE 7 (Con't.)
Alternative Evaluation and Ranking
of Zero-Discharge Alternatives

EVALUATION FACTORS	WEIGHTING FACTOR	ALT 4c Treat/Release All Terminal Ponds		ALT 5 SWMP Option 5d	
		S	W	S	W
CONTROLLED DISCHARGE	10	5	50	5	50
WASTE GENERATION	7	2	14	3	21
RISK	8	3	24	1	8
COST	6	3	18	2	12
DESIGN AND CONSTRUCTION SCHEDULE	6	3	18	2	12
FLEXIBILITY	8	3	24	2	16
WATER RIGHTS	5	5	25	4	20
AIR EMISSIONS	10	2	20	3	30
WETLANDS/T&E	10	2	20	3	30
IHSS	10	4	40	3	30
PUBLIC ACCEPTABILITY	8	4.0	32	3.0	24
TOTALS			285		253
RANK			5		6

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R. A. Applehans, PE/EWE
L. J. McGovern, PE
J. R. McKeown, PE/EWE
F. Walker, FPM
C. R. Rose, Consultant/CWAD
A. McLean, NEPA
A. D. Berzins, EMAD
R. James, CWAD
D. Sassone, S & H
D. Fink/F. Humbert, ISP

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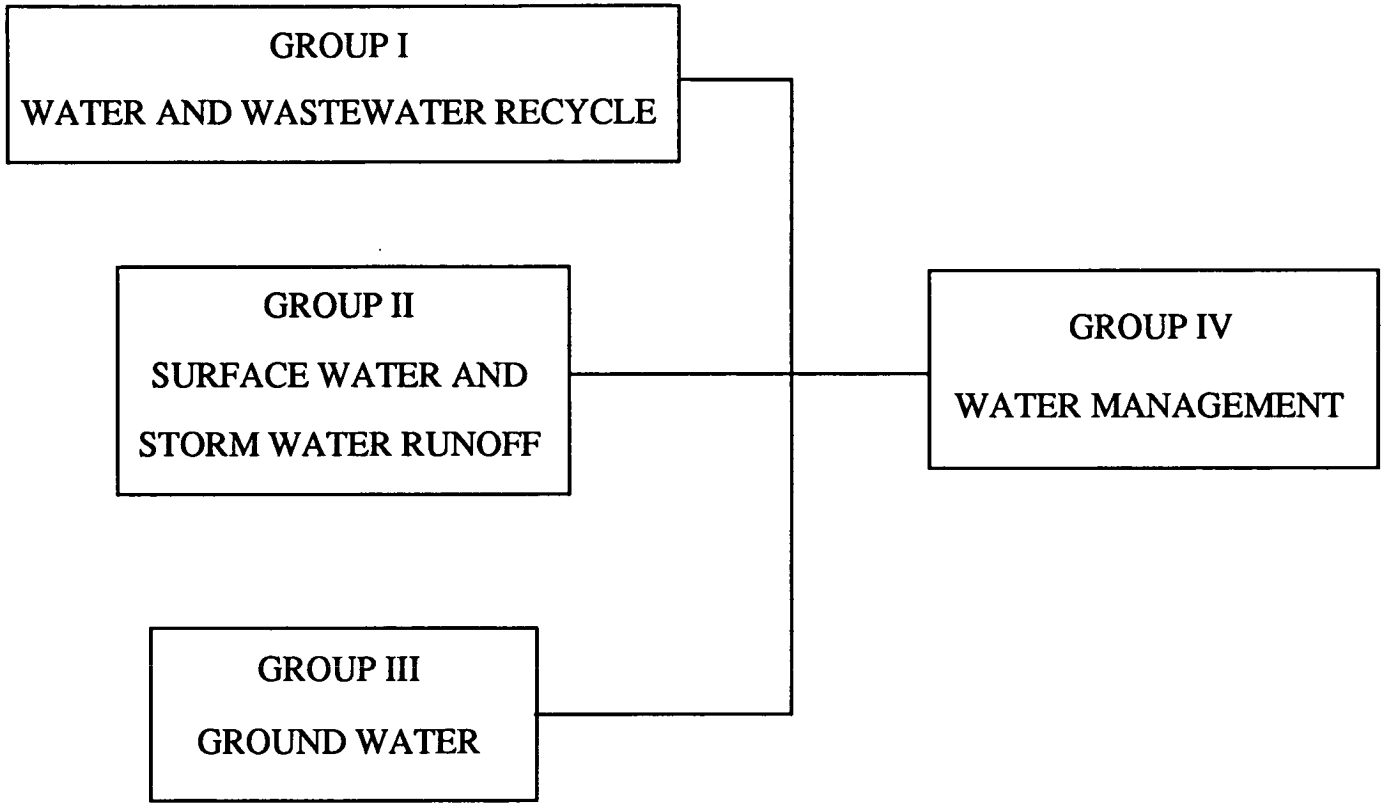
FIGURES



TASK GROUP INTERRELATIONSHIPS

CONSOLIDATION AND ZERO-DISCHARGE PLAN

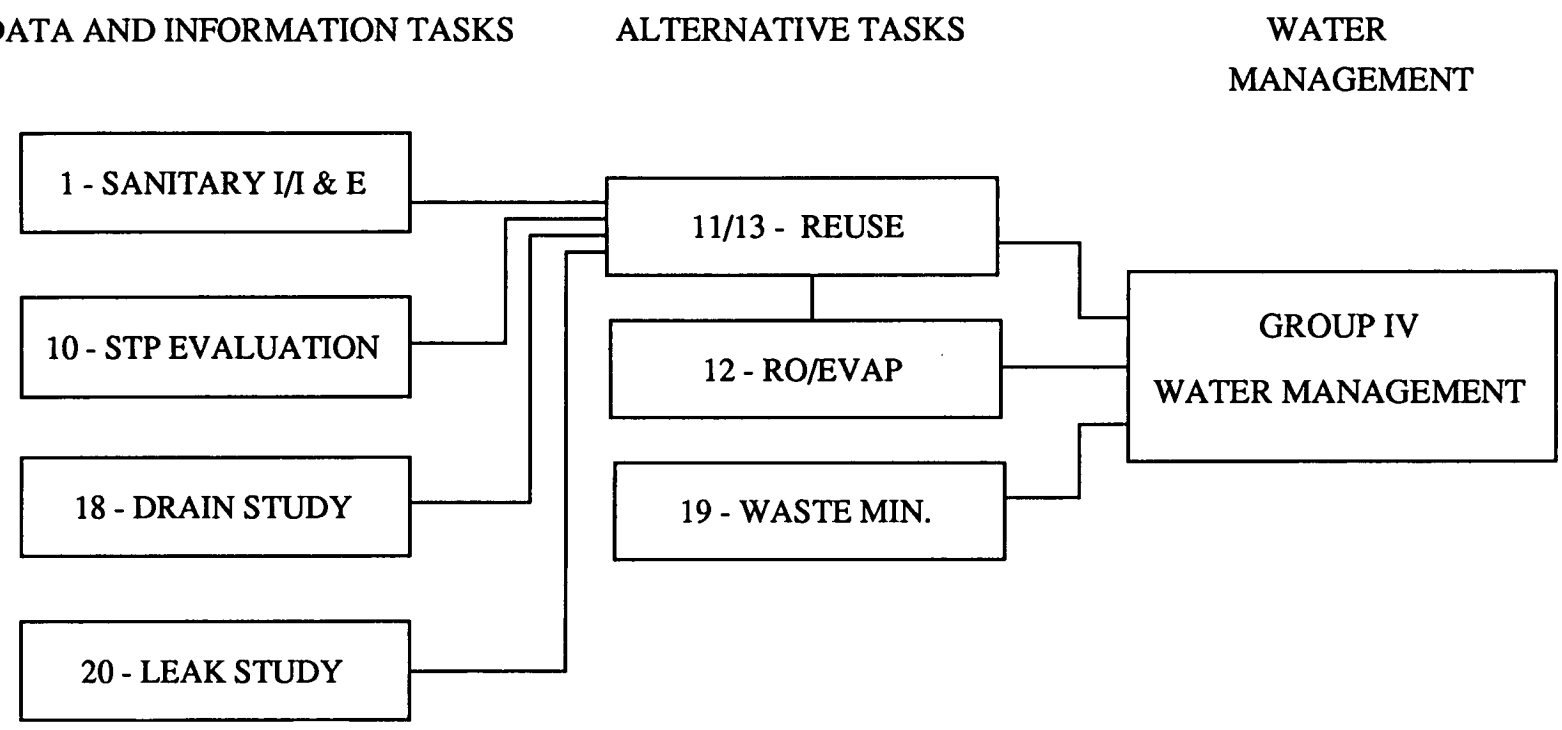
ZERO-OFFSITE WATER DISCHARGE

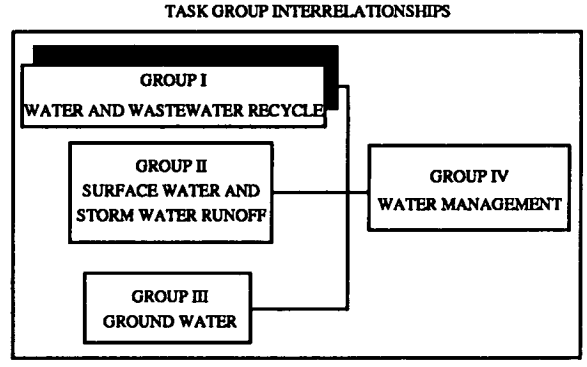
PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 1

ORFLOW-G.DRW





GROUP I - WATER AND WASTEWATER RECYCLE INTERRELATIONSHIPS

CONSOLIDATION AND ZERO-DISCHARGE PLAN

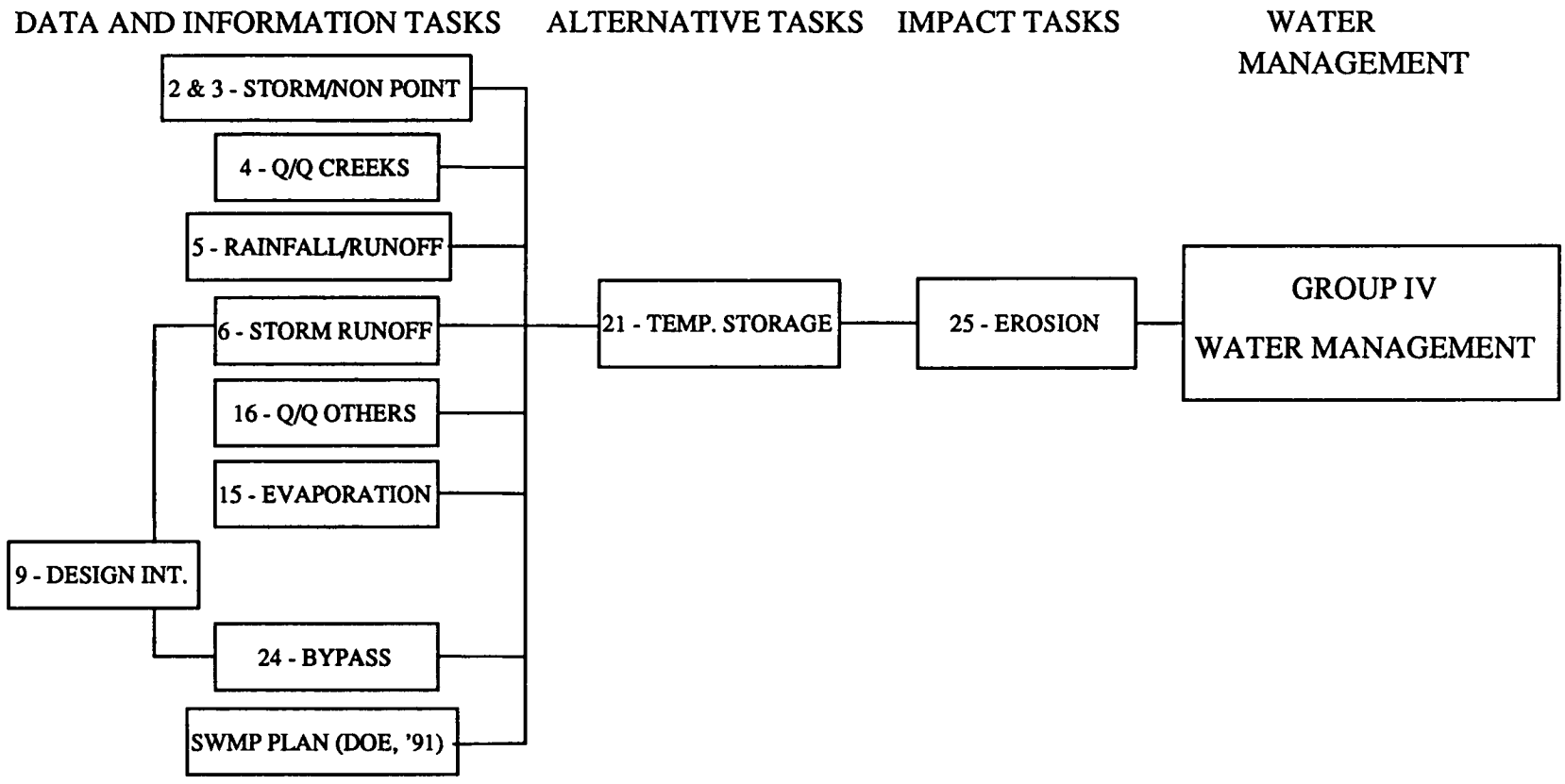
ZERO-OFFSITE WATER DISCHARGE

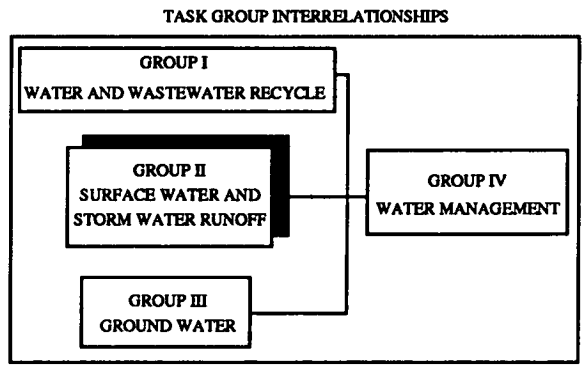
PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 2

ORFLOWH.DRW





GROUP II - SURFACE WATER AND STORM WATER RUNOFF INTERRELATIONSHIPS

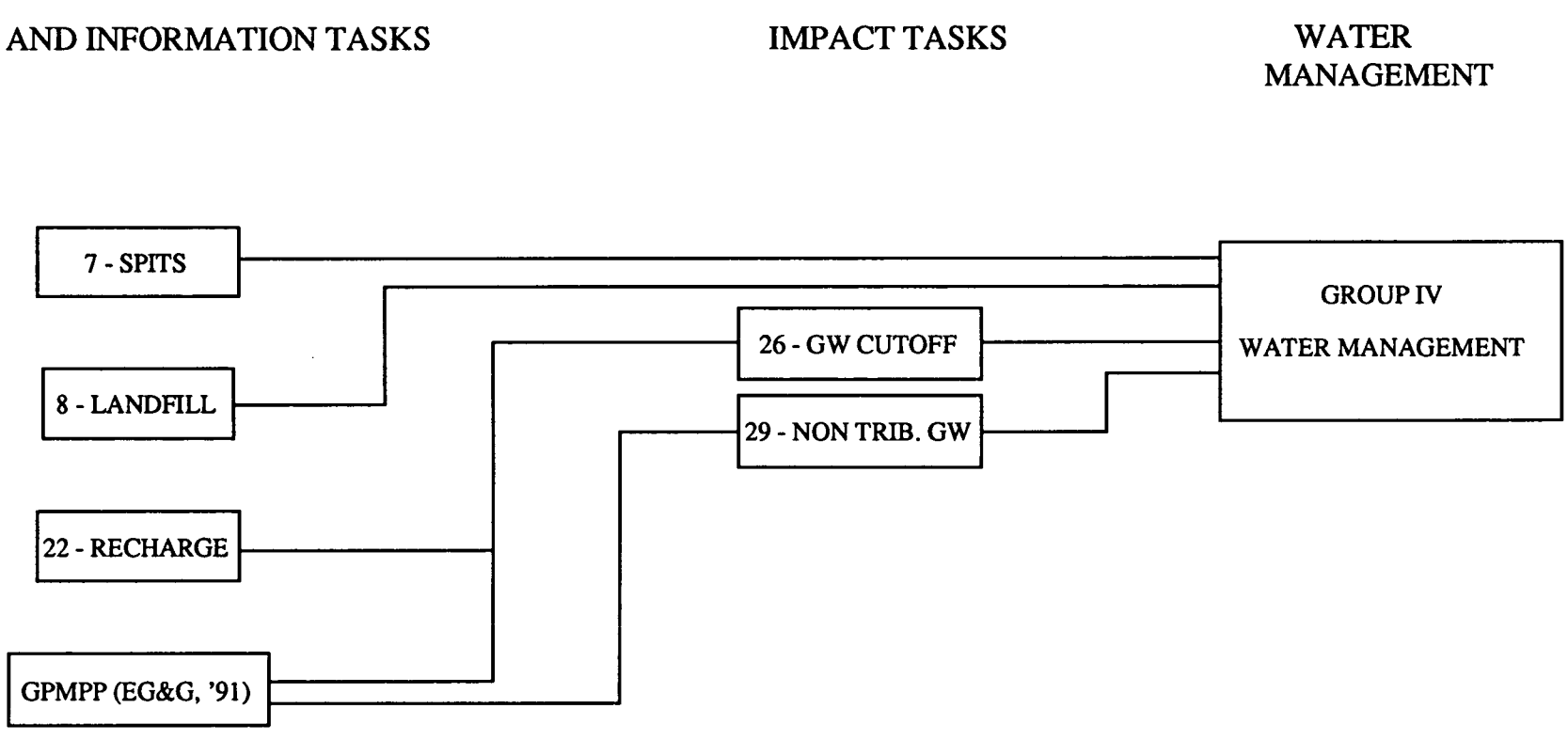
CONSOLIDATION AND ZERO-DISCHARGE PLAN

ZERO-OFFSITE WATER DISCHARGE

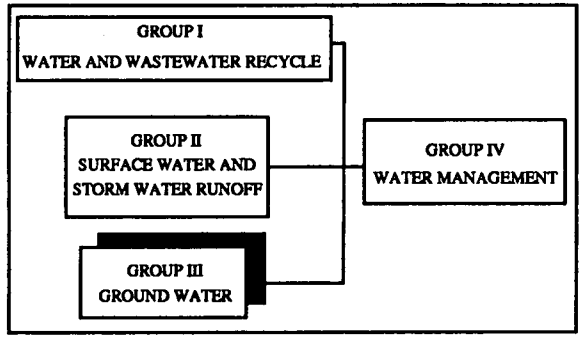
PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 3



TASK GROUP INTERRELATIONSHIPS



GROUP III - GROUND WATER INTERRELATIONSHIPS

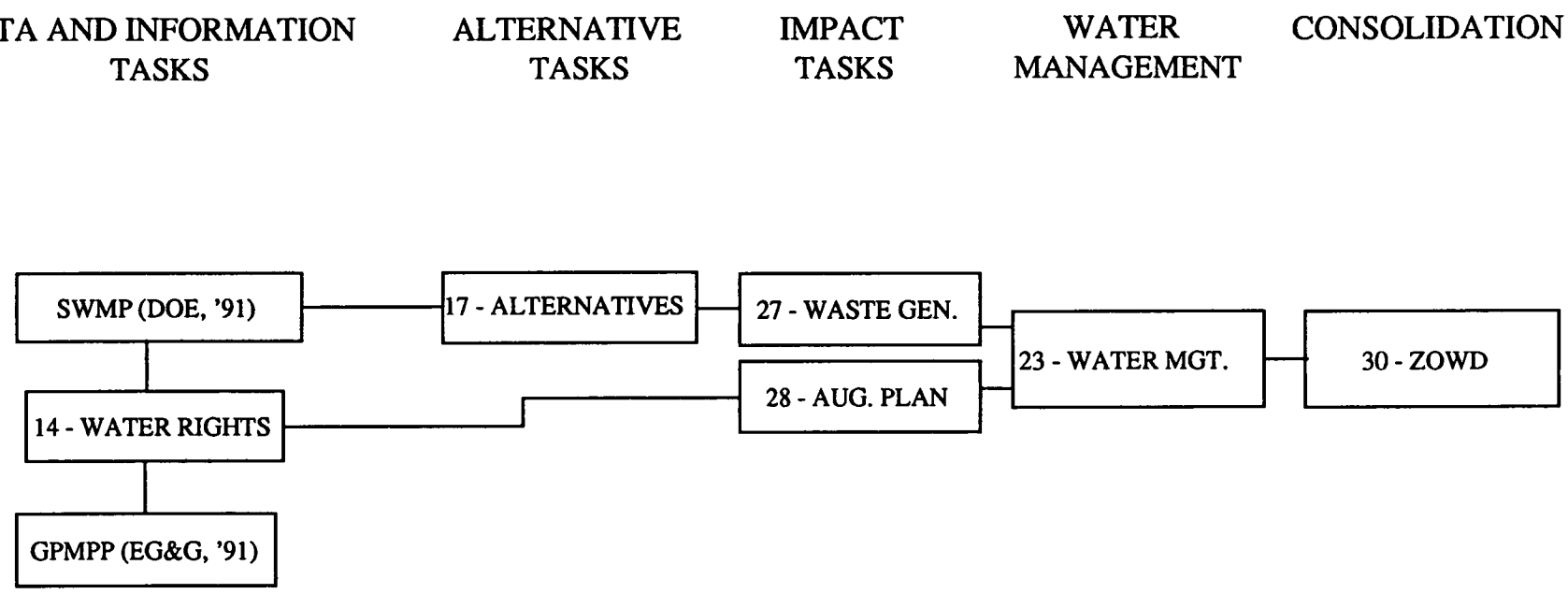
CONSOLIDATION AND ZERO-DISCHARGE PLAN

ZERO-OFFSITE WATER DISCHARGE

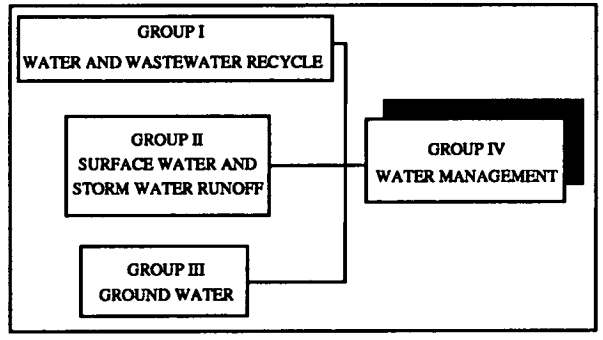
PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 4



TASK GROUP INTERRELATIONSHIPS



GROUP IV - WATER MANAGEMENT INTERRELATIONSHIPS

CONSOLIDATION AND ZERO-DISCHARGE PLAN

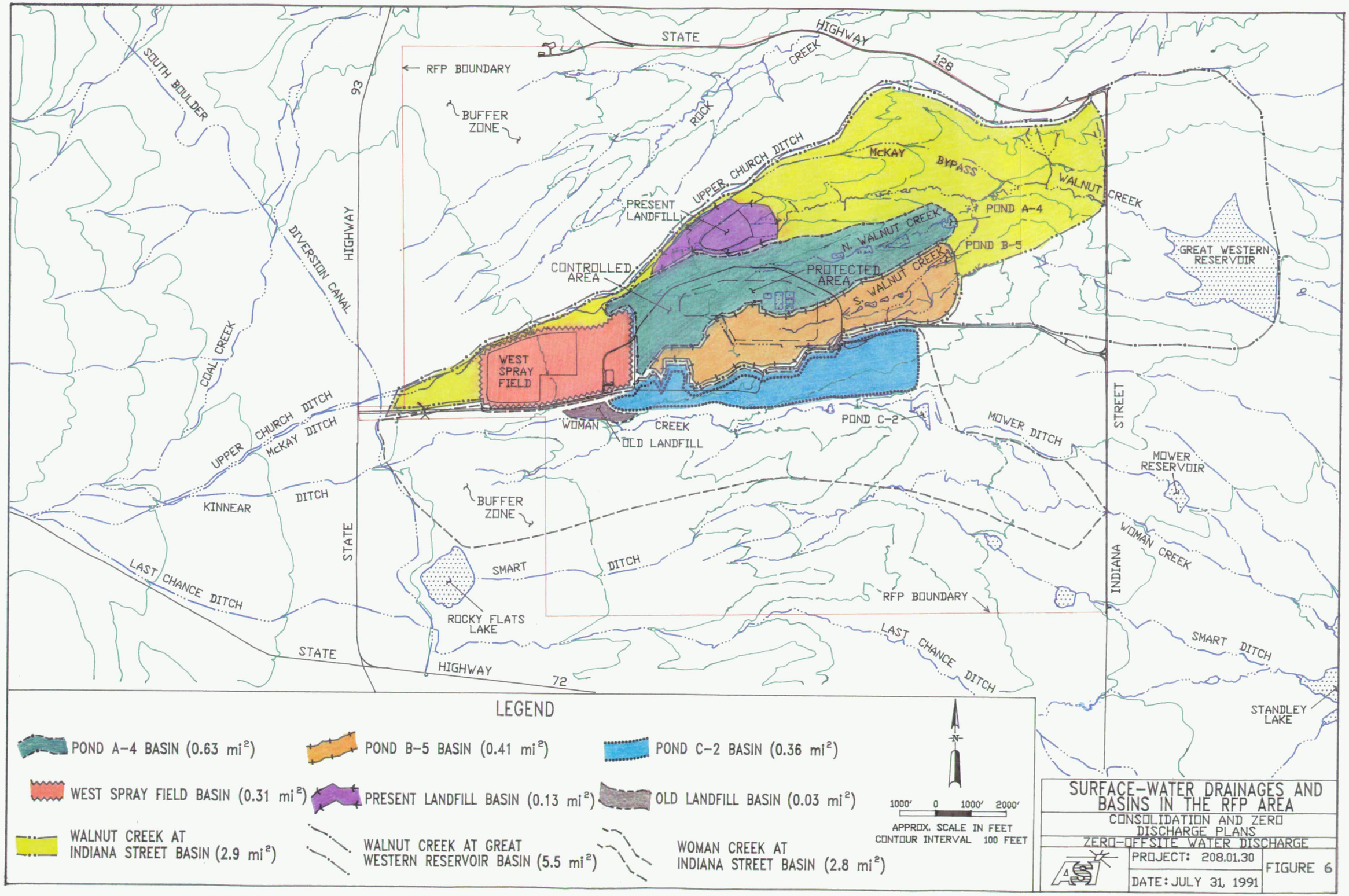
ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 5

OBFLOW4.DRW



SURFACE-WATER DRAINAGES AND BASINS IN THE RFP AREA

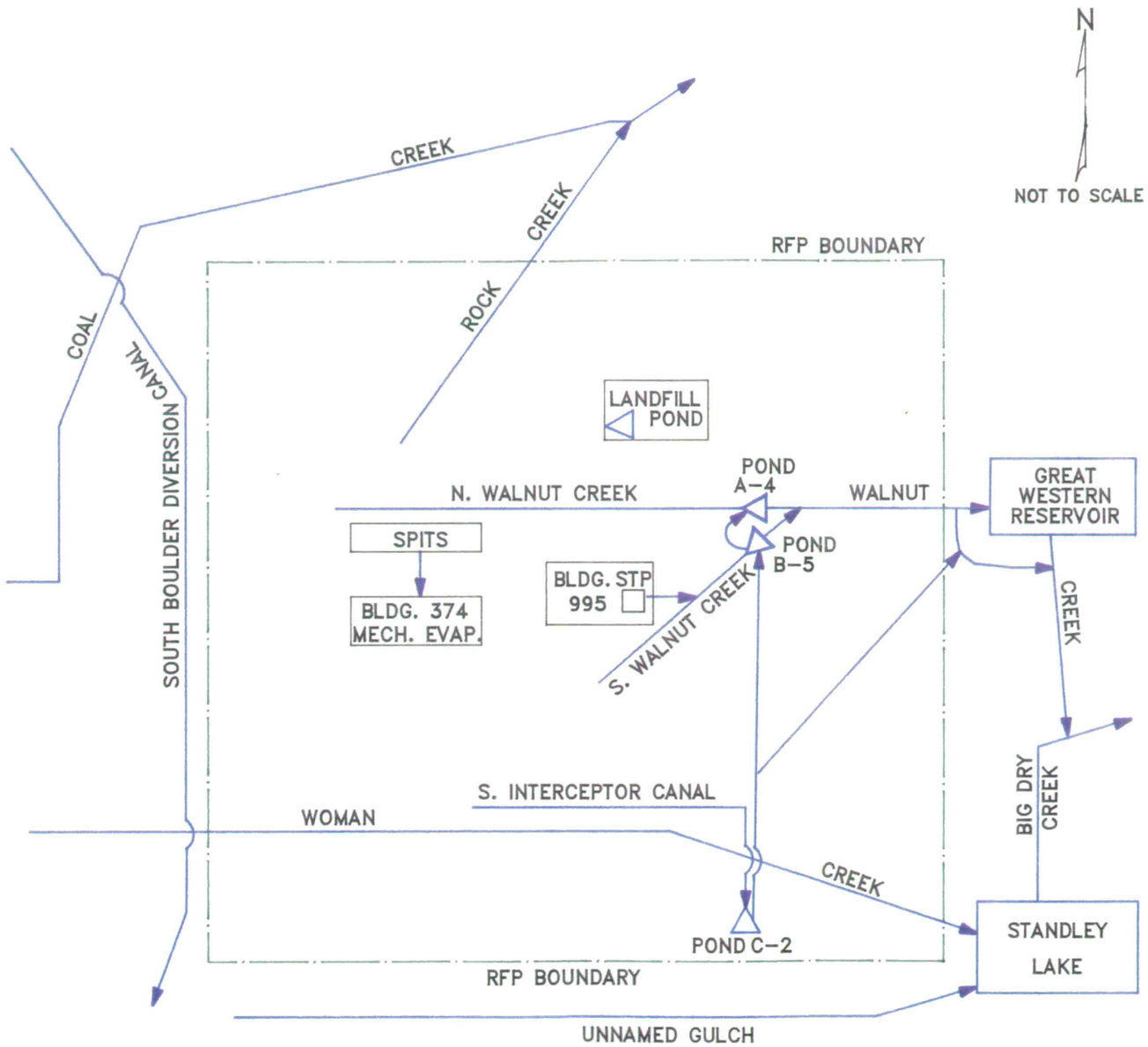
CONSOLIDATION AND ZERO DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.01.30

DATE: JULY 31, 1991

FIGURE 6



KEY

EXISTING FLOW PATH

TASK REFERENCE LIST

COMPONENT	TASK
SANITARY SEWER I/I AND E	1
STORM SEWER I/I AND E AND NON-POINT SOURCE ASSESSMENT	2/3
WATER YIELD/QUALITY OF WALNUT AND WOMAN CREEK WATERSHEDS	4
CONFIRMATION OF RAINFALL/ RUNOFF RELATIONSHIPS	5
STORM RUNOFF QUANTITY FOR VARIOUS DESIGN EVENTS	6
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
DESIGN RECURRENCE INTERVALS	9
STP EVALUATION	10
SURFACE-WATER AND GROUND-WATER RIGHTS	14
SURFACE-WATER EVAPORATION	15
WATER-YIELD/QUALITY OF OTHER SOURCES TRIBUTARY TO STANDLEY LAKE AND GREAT WESTERN RESERVOIR	16
DRAIN STUDY	18
WASTE MINIMIZATION	19
DOMESTIC AND PROCESS WATER PIPELINE LEAK STUDY	20
GROUND-WATER RECHARGE	22
NON-TRIBUTARY GROUND-WATER	29

ALTERNATIVE 1
"NO ACTION"

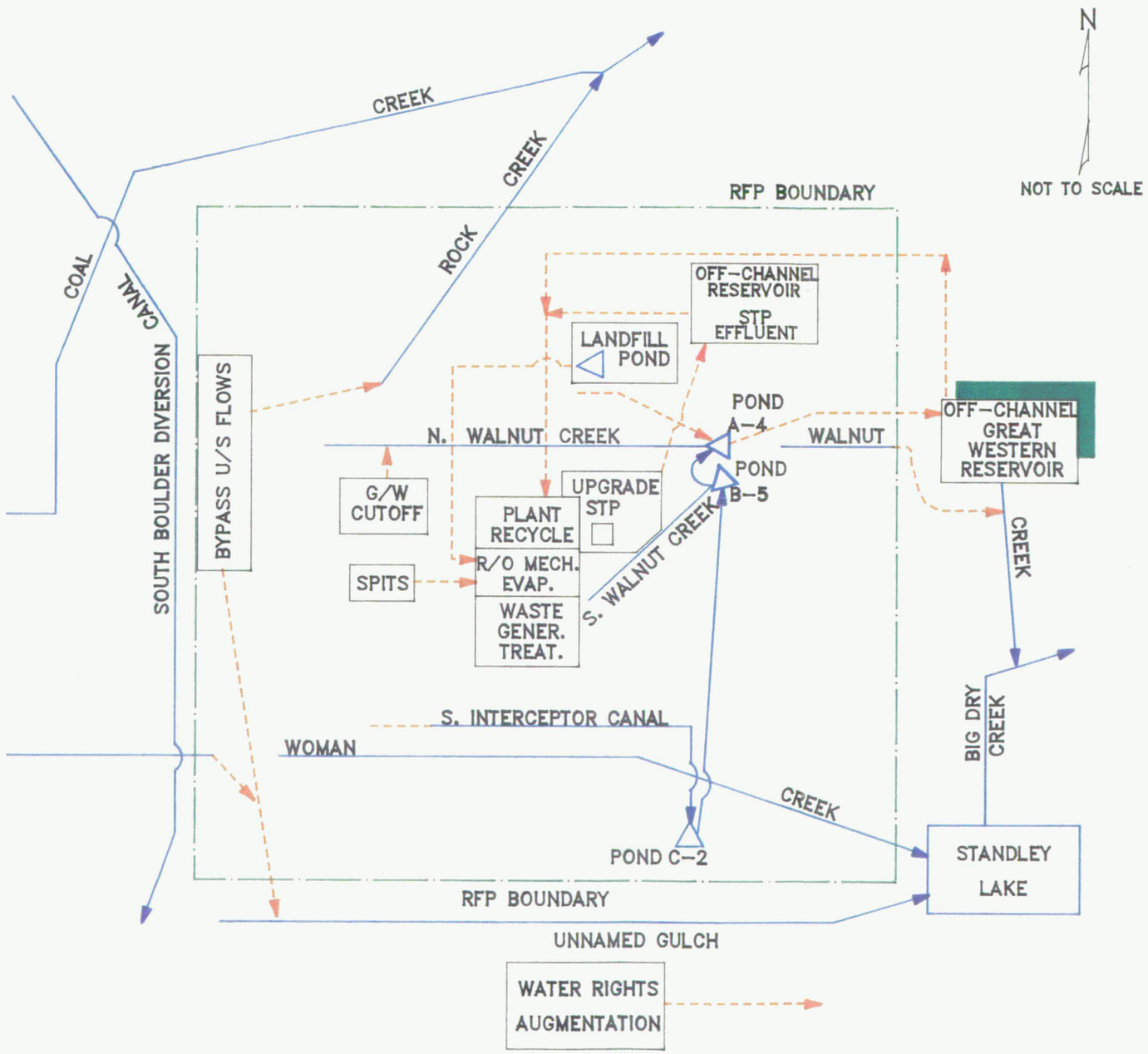
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 7



KEY

- ALTERNATIVE COMPONENT PATHS
- EXISTING FLOW PATHS
- MAJOR ALTERNATIVE COMPONENTS

TASK REFERENCE LIST

COMPONENT	TASK
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
STP EVALUATION	10
PLANT RECYCLE	11/13
RO/MECH. EVAP.	12
SURFACE-WATER AND GROUND-WATER RIGHTS	14
OFF-CHANNEL STP EFFLUENT STORAGE AND GREAT WESTERN RESERVOIR	21
BYPASS U/S FLOWS	24
GROUND-WATER CUTOFF	26
WASTE GENERATION TREATMENT	27
AUGMENTATION	28

ALTERNATIVE 2b
ABSOLUTE ZERO DISCHARGE WITH GREAT WESTERN RESERVOIR

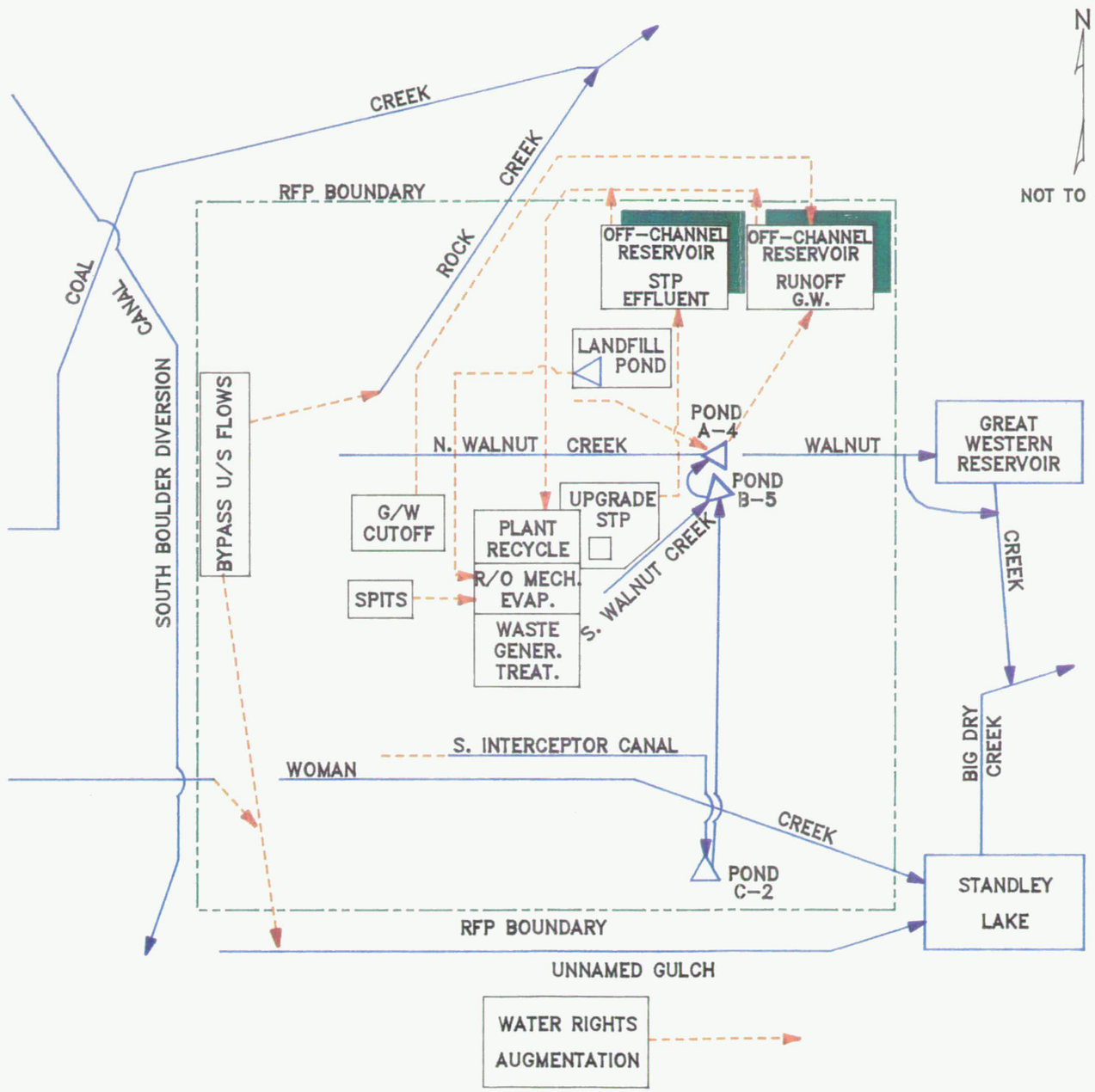
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 9



N

NOT TO SCALE

KEY

- ALTERNATIVE COMPONENT FLOW PATHS
- EXISTING FLOW PATH
- MAJOR ALTERNATIVE COMPONENT

TASK REFERENCE LIST

COMPONENT	TASK
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
STP EVALUATION	10
PLANT RECYCLE	11/13
RO/MECH. EVAP.	12
SURFACE-WATER AND GROUND-WATER RIGHTS	14
OFF-CHANNEL RUNOFF/GROUND-WATER AND STP STORAGE	21
BYPASS U/S FLOWS	24
GROUND-WATER CUTOFF	26
WASTE GENERATION TREATMENT	27
AUGMENTATION	28

ALTERNATIVE 2a
ABSOLUTE ZERO DISCHARGE WITH NEW OFF-CHANNEL STORAGE

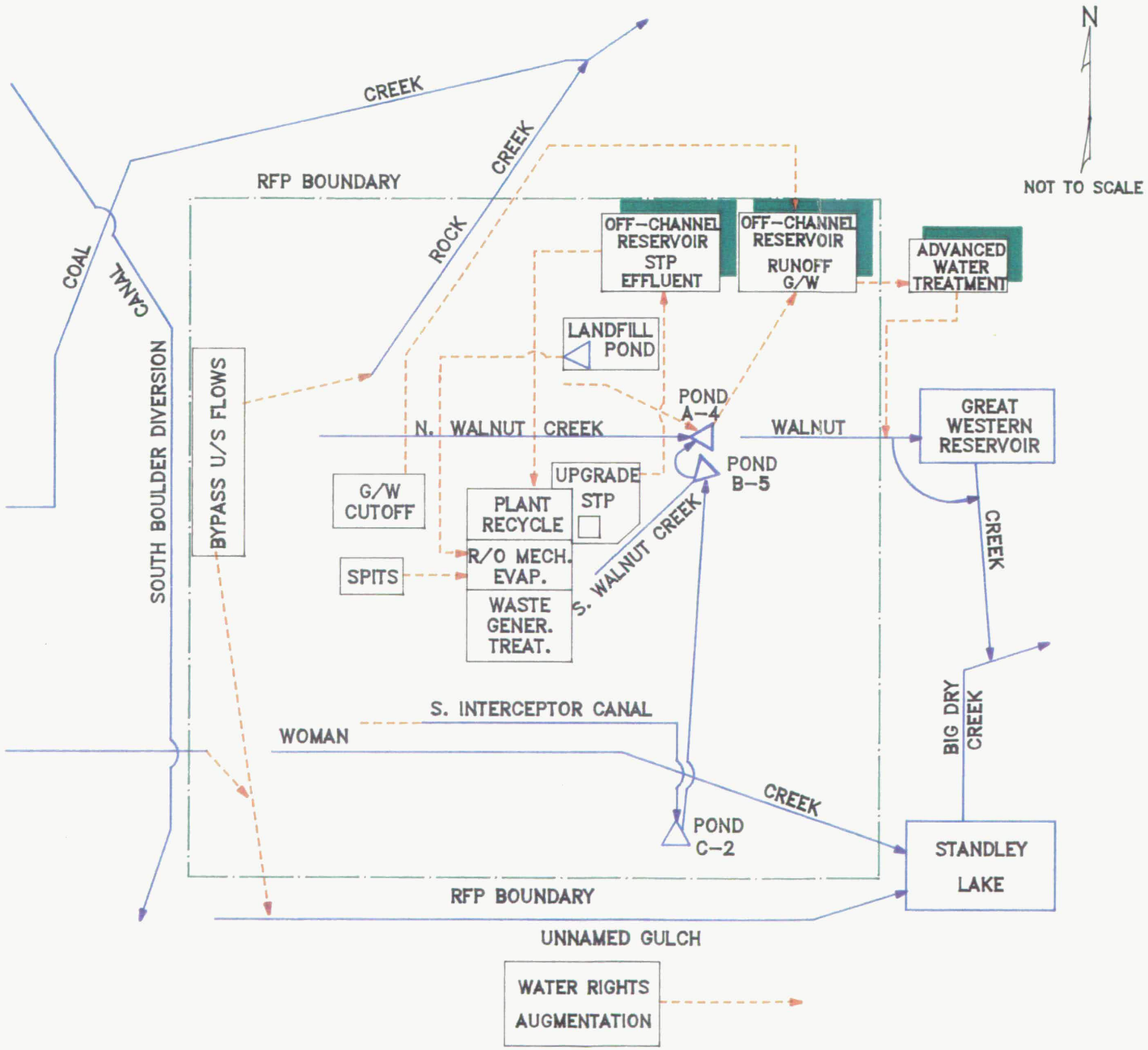
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 8



N

NOT TO SCALE

KEY

- ALTERNATIVE COMPONENT FLOW PATHS
- EXISTING FLOW PATH
- MAJOR ALTERNATIVE COMPONENT

TASK REFERENCE LIST

COMPONENT	TASK
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
STP EVALUATION	10
PLANT RECYCLE	11/13
RO/MECH. EVAP.	12
SUFACE-WATER AND GROUND-WATER RIGHTS	14
ALTERNATIVES TO ZERO DISCHARGE	17
ADVANCED WATER TREATMENT AND OFF-CHANNEL STORAGE	21
BYPASS U/S FLOWS	24
GROUND-WATER CUTOFF	26
WASTE GENERATION TREATMENT	27
AUGMENTATION	28

ALTERNATIVE 3
ZERO DISCHARGE OF STP EFFLUENT WITH TREATMENT AND DISCHARGE OF SURFACE WATER AND GROUND WATER

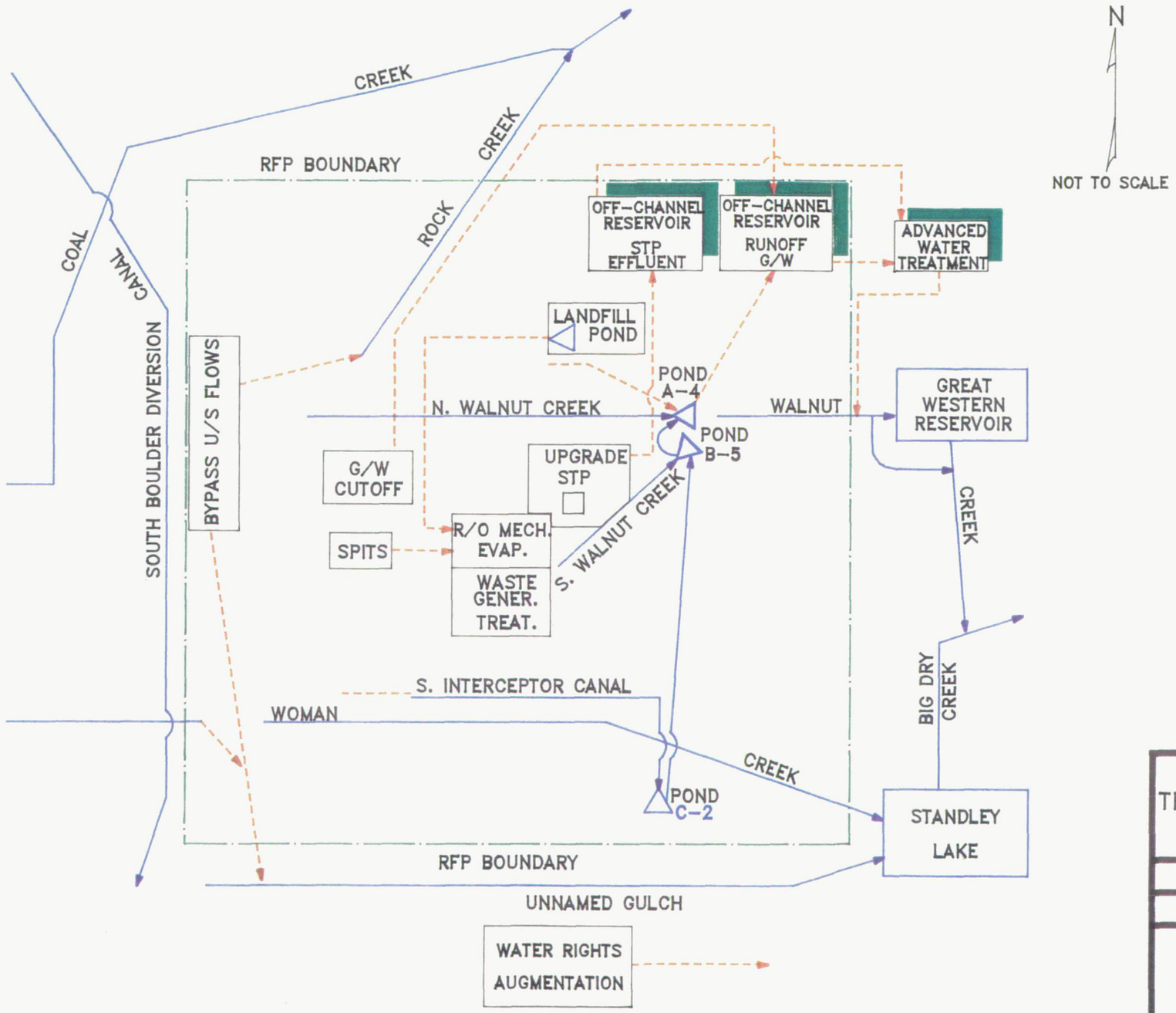
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 10



N

NOT TO SCALE

LEGEND

- ALTERNATIVE COMPONENT PATHS
- EXISTING FLOW PATH
- MAJOR ALTERNATIVE COMPONENT

TASK REFERENCE LIST

COMPONENT	TASK
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
STP EVALUATION	10
RO/MECH. EVAP.	12
SURFACE-WATER AND GROUND-WATER RIGHTS	14
ALTERNATIVES TO ZERO DISCHARGE	17
ADVANCED WATER TREATMENT AND OFF-CHANNEL STORAGE	21
BYPASS U/S FLOWS	24
GROUND-WATER CUTOFF	26
WASTE GENERATION TREATMENT	27
AUGMENTATION	28

ALTERNATIVE 4a
TREATMENT AND DISCHARGE OF ALL WATER
NEW OFF-CHANNEL STORAGE RESERVOIR

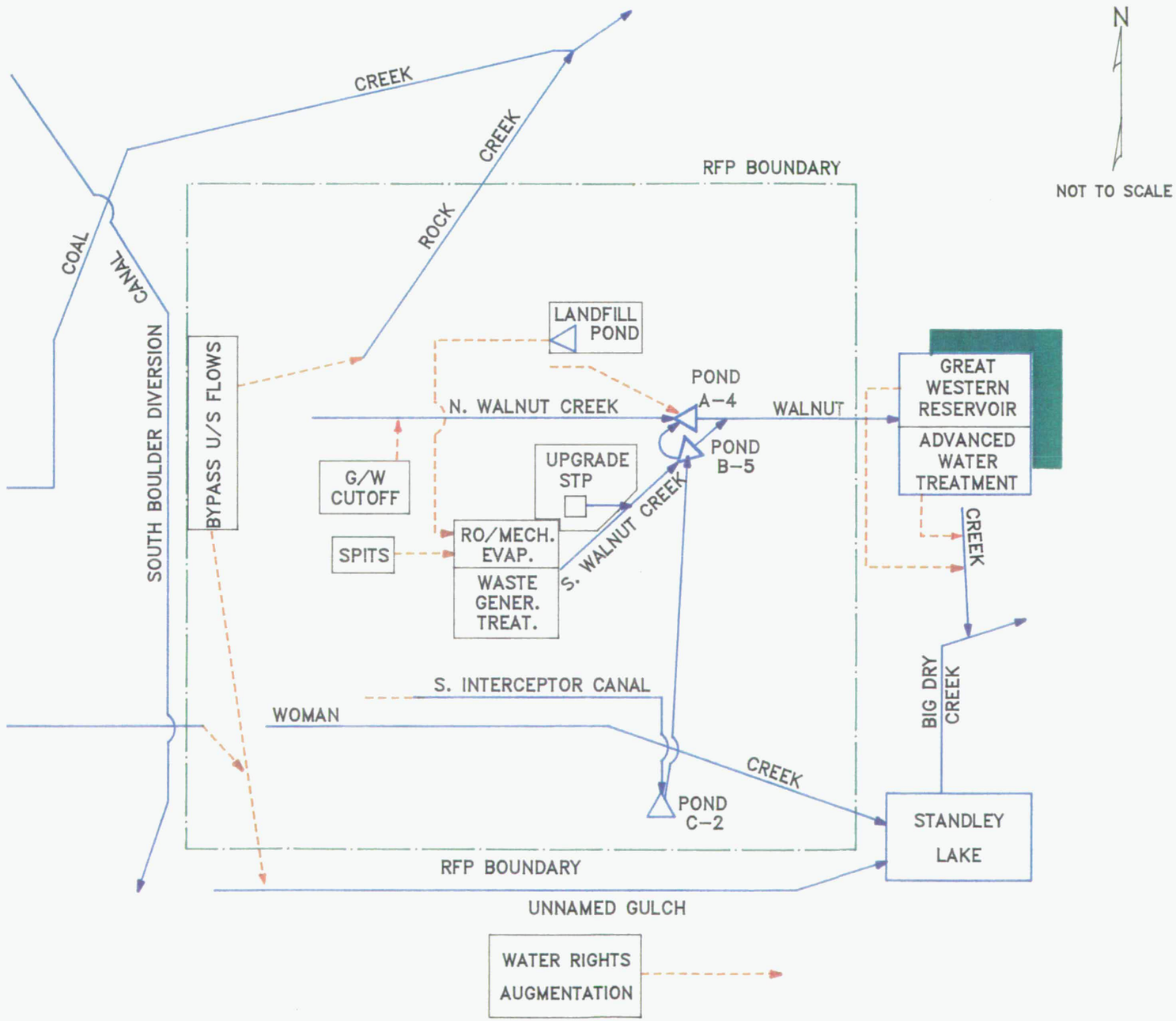
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 11



N

NOT TO SCALE

LEGEND

- ALTERNATIVE COMPONENT PATHS
- EXISTING FLOW PATH
- MAJOR ALTERNATIVE COMPONENT

TASK REFERENCE LIST

COMPONENT	TASK
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
STP EVALUATION	10
RO/MECH. EVAP.	12
SURFACE-WATER AND GROUND-WATER RIGHTS	14
ALTERNATIVES TO ZERO DISCHARGE	17
GREAT WESTERN RESERVOIR/ ADVANCED WATER TREATMENT	21
BYPASS U/S FLOWS	24
GROUND-WATER CUTOFF	26
WASTE GENERATION TREATMENT	27
AUGMENTATION	28

ALTERNATIVE 4b
TREATMENT AND DISCHARGE OF ALL WATER
GREAT WESTERN RESERVOIR STORAGE

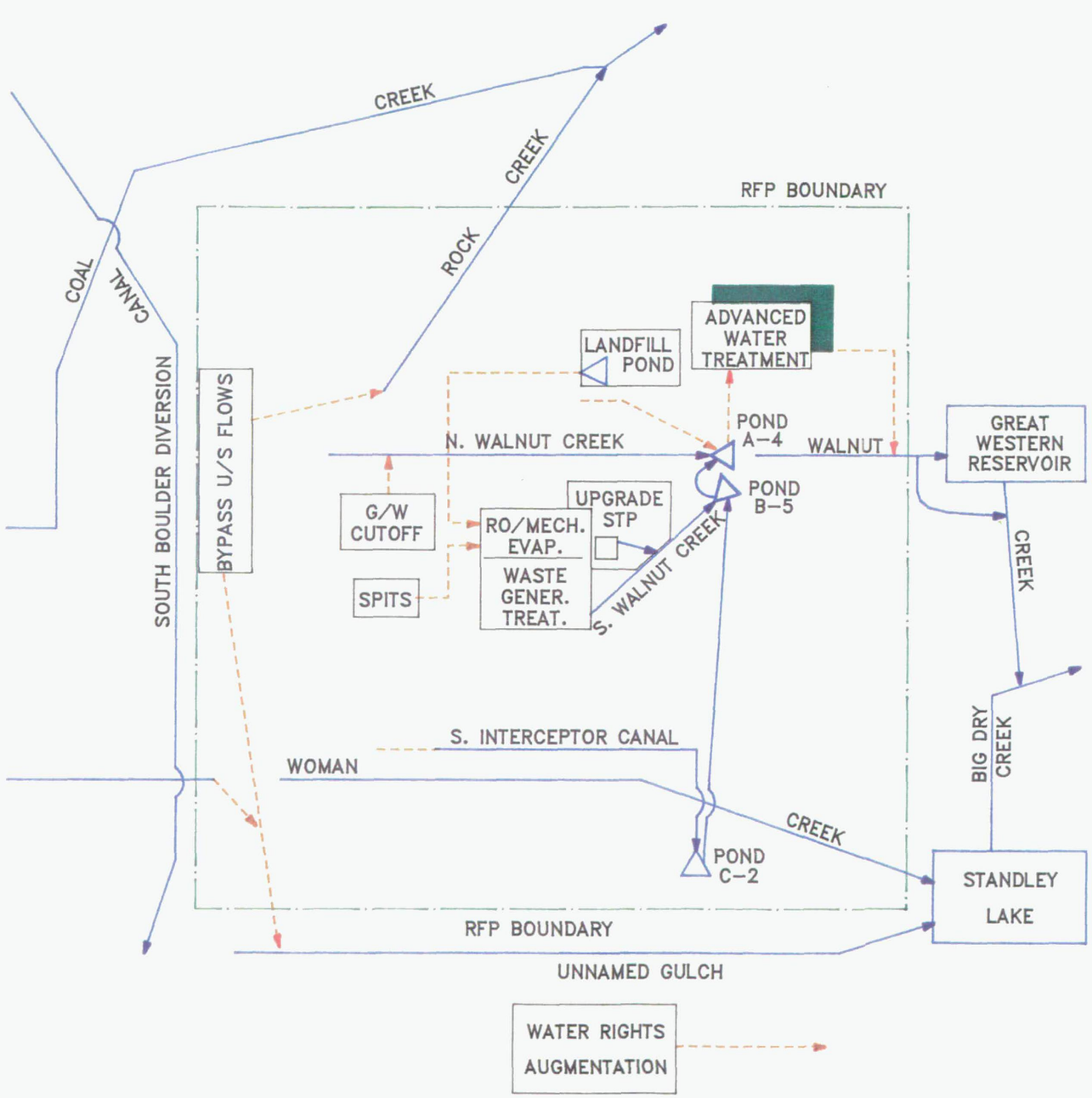
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 12



N

NOT TO SCALE

LEGEND

- ALTERNATIVE COMPONENT PATHS
- EXISTING FLOW PATH
- MAJOR ALTERNATIVE COMPONENT

TASK REFERENCE LIST

COMPONENT	TASK
SOLAR POND INTERCEPTOR TRENCH SYSTEM (SPITS)	7
LANDFILL POND	8
STP EVALUATION	10
RO/MECH. EVAP.	12
SURFACE-WATER AND GROUND-WATER RIGHTS	14
ALTERNATIVES TO ZERO DISCHARGE	17
TERMINAL PONDS/ ADVANCED WATER TREATMENT	21
BYPASS U/S FLOWS	24
GROUND-WATER CUTOFF	26
WASTE GENERATION TREATMENT	27
AUGMENTATION	28

ALTERNATIVE 4c
TREATMENT AND DISCHARGE OF ALL WATER
EXISTING TERMINAL PONDS STORAGE

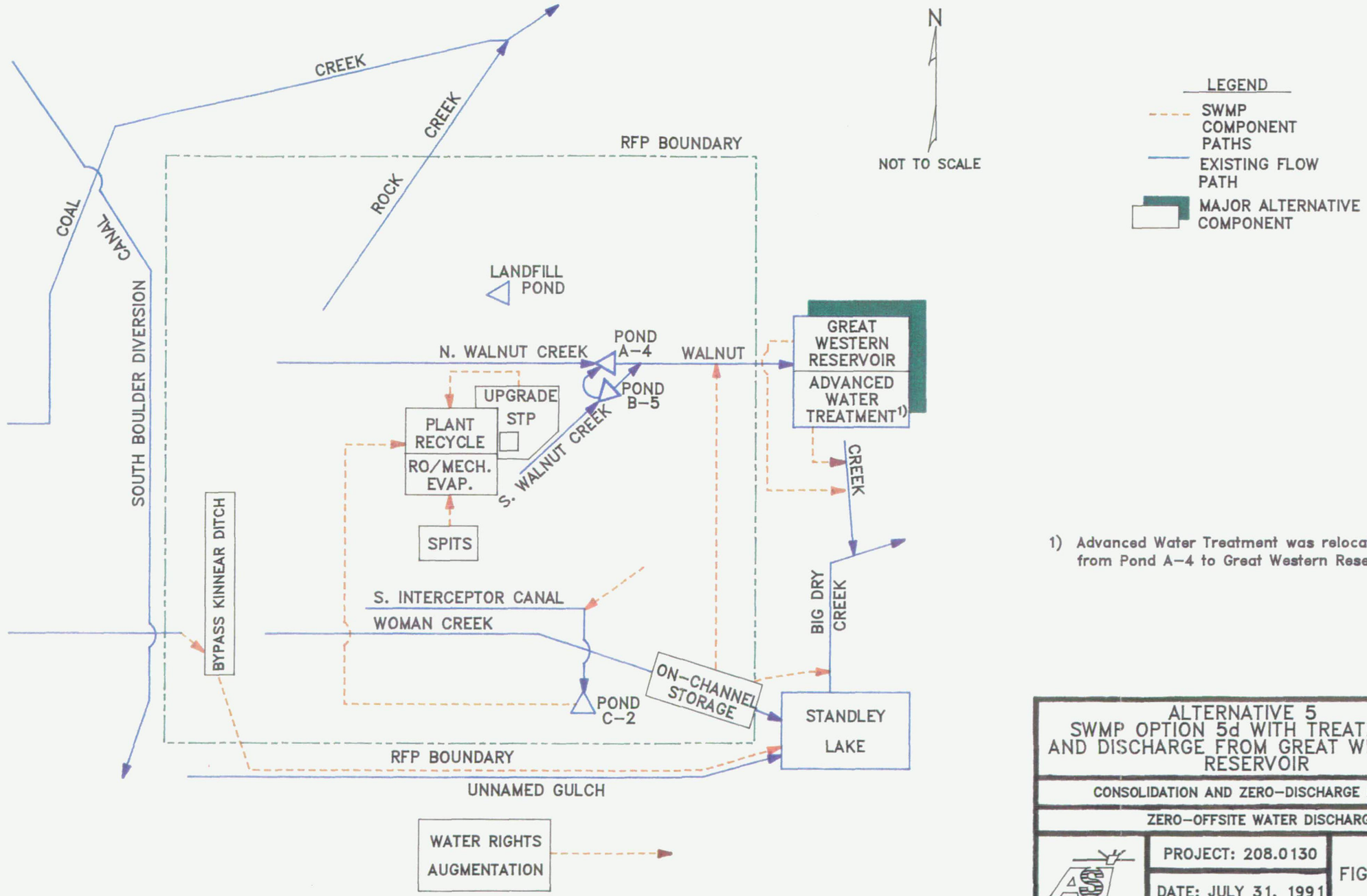
CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 13



1) Advanced Water Treatment was relocated from from Pond A-4 to Great Western Reservoir.

ALTERNATIVE 5
SWMP OPTION 5d WITH TREATMENT AND DISCHARGE FROM GREAT WESTERN RESERVOIR

CONSOLIDATION AND ZERO-DISCHARGE PLANS

ZERO-OFFSITE WATER DISCHARGE

PROJECT: 208.0130

DATE: JULY 31, 1991

FIGURE 14

A

APPENDIX A

REGULATORY CONSIDERATIONS

APPENDIX A
REGULATORY CONSIDERATIONS

The **Atomic Energy Act (AEA)** of 1954 [42 USC §§ 2011, et seq., as amended, 1988 & Supp. 1990] governs activities involving atomic energy and requires the safe management of radiation associated with these activities. The AEA does not expressly regulate water management at DOE facilities, but does vest the U.S. Government with primary authority to regulate activities at nuclear facilities, including protection of the health and safety of the public (Sec. 2012(a)).

The **Department of Energy Organization Act (DOEOA)** [42 USC §§ 7101, et seq., as amended, 1988] created the DOE in 1977 and delegated the administration and coordination of the Nation's energy policy to this Department. DOE is also responsible for assuring incorporation of national environmental protection goals; advancing the goals of restoring, protecting, and enhancing environmental quality; and assuring public health and safety. DOE is required to issue orders to implement its environmental obligations under the AEA and DOEOA. DOE orders in the 5400 series deal with environmental protection requirements.

DOE Order 5400.1, "General Environmental Protection Program Requirements," was created to establish environmental protection program requirements, authorities, and responsibilities to assure that DOE operations comply with applicable Federal, State, and local environmental protection laws and regulations, Executive Orders, and DOE policies. This Order specifies the responsibilities of various DOE officials for achieving environmental compliance. It also requires notification and follow-up of environmental occurrences, such as unplanned releases of pollutants and preparation of an annual site environmental report, including reporting of monitoring. The Order requires DOE to develop and implement specific program plans for Federal facilities such as the RFP (EG&G, 1991b; EG&G, 1991a; DOE, 1988).

The main program being developed for RFP compliance with DOE Order 5400.1 is the Environmental Protection Implementation Plan (EPIP). This program, in turn, is composed of the Surface Water Management Plan (SWMP) (EG&G, 1991b), the Groundwater Protection and

Monitoring Program Plan (GPMPP) (EG&G, 1991a), the Environmental Monitoring Plan (EMP), the Long Range Environmental Protection Plan (LREPP), the Waste Minimization Program (WMP), and the Pollution Prevention Awareness Program (PPAP).

DOE Order 5400.2A establishes DOE requirements for coordination of significant environmental compliance issues to ensure timely development and consistent application of DOE environmental policy and guidance.

DOE Order 5400.4 establishes and implements DOE CERCLA policies and procedures within the framework of DOE Order 5400.1.

DOE Order 5400.4, "CERCLA Requirements," requires that DOE, Federal, State, and local entities execute the Remedial Investigation/Feasibility Study (RI/FS) and remedial actions as prescribed in DOE Order 5400.2A.

DOE Order 5400.5, "Radiation Protection of the Public and the Environment" states that soil and ground water are not acceptable receptacles for radioactive liquid waste streams, and decrees that soil and ground water which have been contaminated by liquid discharges are to be managed or decontaminated pursuant to 5400.4, and that controls will be implemented to prevent the concentration of radionuclides in the ground water from exceeding applicable Federal, State, and local standards at the time the property is released. This Order establishes standards and requirements for operations of the RFP designed to protect the public and the environment from the risks of radiation exposure. The Order adopts "best available technology" (BAT) as the appropriate level of treatment for liquid wastes containing radioactive material with the understanding that radiation levels will be "as low as reasonably achievable" (ALARA). Any release of radiation is subject to DOE's ALARA principle. The Order specifies that discharges of liquid waste to aquifers and soil columns are to be discontinued at the earliest practicable time. Soil columns which are generally used to filter out particles as water seeps through them are not used at the RFP for removal or retention of radionuclides from the liquid waste stream. Soil columns are, however, a component of previously used spray irrigation systems that reduce the

volume of the Plant's discharge as allowed under the EPA NPDES permit and also consist of earthen, unlined ponds used for impoundment of water prior to sampling and discharge as required by the AIP and the NPDES permit (EG&G, 1991b).

DOE Orders 5480.1, 5482.1, and 5484.1 establish the Environment, Safety, and Health (ES&H) Program for DOE operations.

The President has the power to issue Executive (Presidential) Orders which are binding on regulatory agencies (such as the DOE) within the Executive branch. On October 13, 1978, President Jimmy Carter issued **Executive Order 12088, "Federal Compliance With Pollution Control Standards."** This Order was promulgated to insure Federal compliance with applicable pollution control standards. The Order requires the head of each Executive agency to ensure Federal compliance with applicable pollution control standards and also specifically requires DOE to comply with the Clean Water Act (CWA) and the AEA. It also allows the agency to secure an exemption from applicable pollution control standards if the President determines that the exemption is necessary in the interest of national security or is in the paramount interest of the U.S. The Order requires a plan to be developed to achieve and maintain pollution control standards for the RFP (the NPDES Federal Facility Compliance Agreement contains such a plan) (EPA, 1991a).

The **National Environmental Policy Act (NEPA)** of 1969 [42 USC §§ 4321, et seq., as amended, 1975] established a broad national environmental policy by requiring Federal agencies to evaluate their major actions for environmental impact. This evaluation must occur early in the decision-making process, be expressed in a written environmental document (either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS)), and be available for public comment. The EA or EIS will serve as a guide for making a decision on the proposed action (Arbuckle and others, 1989).

The EA or EIS must address such items as impacts on floodplains and wetlands, threatened and endangered species, water resources, air quality, noise, cultural resources, land use,

socioeconomic impacts, and health and safety. An EA is typically performed when the anticipated impacts of the proposed action are either not significant or can be mitigated to the extent that the net impact is less than significant. The conclusion of such a document is called a Finding Of No Significant Impact (FONSI). An EIS is usually performed when the anticipated impacts are significant. An EIS includes analyses of more alternatives to the preferred option, but does not need to address mitigating measures.

In 1979, the **Council on Environmental Quality (CEQ)** promulgated regulations under NEPA. These regulations provide guidance for implementing NEPA and are found within 40 CFR Part 1500 and were amended in 1986.

At the RFP, the NEPA process begins when an Action Description Memorandum (ADM) is submitted by the Plant Contractor to DOE. DOE may find the ADM sufficient to show that the action is not a major federal action and issue a Memo-to-File if the environmental effects will be insignificant. DOE may require preparation of either an EA or EIS if the proposed action is a major action. If an EA is required, the Contractor is responsible for its preparation. If an EIS is needed, DOE is responsible for its preparation. An EA is followed by a FONSI, as discussed above; and an EIS is followed by a Record of Decision (ROD).

The implementation of documentation requirements for NEPA at the RFP are guided by DOE Order 5440.1C, Secretary of Energy Notice SEN-15-90 (1990), and the Draft DOE NEPA Compliance Guide (1985). Furthermore, implementation of these external requirements is accomplished in accordance with RFP procedure EMM-0800-1, "Implementation of Documentation Requirements for NEPA."

The future mission of the RFP remains in doubt. There are at least three EISs and numerous EAs which are in progress or about to begin which will affect the future of the plant (EG&G, 1991a). Any of the EISs or EAs may result in the implementation of mitigation plans which may influence water management at the RFP. These EAs and EISs include:

- Programmatic EIS on the future of the U.S. Weapons Complex. This programmatic EIS is nation-wide in scope and will have a direct influence on the future of the RFP. Included in the scope of this EIS are such issues as alternative locations for plutonium fabrication other than the RFP.

- Programmatic EIS on the Environmental Restoration (ER) programs throughout the U.S. nuclear weapons facilities. This EIS will influence ongoing ER programs at the RFP and may constrain the range of actions available to water managers at the RFP. CERCLA (or Superfund) actions may take precedence over EIS recommendations.

- Site-wide EIS (SWEIS) for the RFP. This EIS will replace and supplement the 1980 Final EIS for the RFP (DOE, 1980). It is expected that the SWEIS will deal with the environmental issues associated with the RFP over the relatively short term, that is, the next five to ten years. Issues appropriate for this EIS will include cumulative impact of the many activities at the RFP, including those associated with the CDH/DOE AIP which is the primary driving force for this study.

- Other site-specific or building-specific EAs and EISs have been and will continue to be developed as required to comply with NEPA and DOE directives. These include EAs being developed for environmental restoration sites, such as the 881 Hillside Interim Remedial Actions (DOE, 1990a).

EG&G recently published a "Corrective Action Plan" (DOE, 1990b) to synthesize the DOE/EG&G response to the 1989 Tiger Team report (DOE, 1989). The Tiger Team assessment was an independent review of the RFP operations and its compliance with applicable federal, State, and local regulations, permit requirements, agreements, orders and consent decrees, and DOE orders. In addition to evaluating compliance, the Tiger Team examined RFP operations for

conformance with relevant "best" and "accepted" industrial practices to test the adequacy of the RFP's management programs.

The Corrective Action Plan (DOE, 1990b) reviews the 52 audit findings and 43 best management practices contained in the Tiger Team Report. A formal planning process for waste and environmental programs was established through the preparation of five-year planning documents which are to be updated annually. Additional funds as necessary have been requested to support programs identified within the five-year plan. It is expected that the results of this zero-offsite water-discharge water resource management plan will be input into the five-year planning process.

Both the Rocky Flats SWMP (EG&G, 1991b) and the GPMPP (EG&G, 1991a) were driven by DOE order 5400.1. These two documents were included in the interrelationships described in the consolidation of zero-discharge tasks.

The **Resource Conservation and Recovery Act (RCRA)** of 1976 [42 USC §§ 6901, et seq., as amended, 1984] was designed by Congress to require the "cradle-to-grave" management of hazardous waste. The State of Colorado has the responsibility for implementing RCRA [CRS §§ 25-15-101, et seq.]. The CDH, through the Hazardous Materials and Waste Management Division, implements RCRA in Colorado.

RCRA focuses on the management of hazardous waste through a system of manifesting, record-keeping, and permitting. Significantly for the RFP, however, it also includes a provision authorizing corrective actions where hazardous waste is being released from a site that falls within the jurisdiction of RCRA. The Interagency Agreement (IAG) sets forth the areas at the RFP that are subject to RCRA corrective action, and hence subject to regulation by the State as a Lead Regulatory Agency.

In 1984, RCRA was amended by the Hazardous and Solid Waste Amendments (HSWA) [within 42 USC §§ 6901, et seq.]. RCRA regulations are contained in 40 CFR Parts 200 through 299.

These regulations set a variety of substantive standards for the management of hazardous waste at RCRA sites. Many of these standards may apply to the remedial action at the RFP (Arbuckle and others, 1989).

EPA authorized CDH under RCRA Section 3006 to administer and enforce a Colorado hazardous waste management plan in lieu of the Federal plan. Colorado enacted the **Colorado Hazardous Waste Act (CHWA)** in 1983 [CRS §§ 25-15-101, et seq.]. Colorado is one of 19 states authorized by EPA to regulate radioactive mixed wastes under RCRA. The generation, treatment, storage, and disposal of hazardous waste at the Rocky Flats Site is regulated by the State pursuant to CHWA and regulations governing the management of hazardous wastes contained within 6 CCR 1007-3 (EPA, 1991a).

A hazardous waste treatment, storage, and disposal site is to be treated as either an Interim Status site or a Fully Permitted site. Monitoring requirements depend on the site status. An Interim Status site is one that was in existence prior to 1981 and is "grandfathered" under the RCRA regulations until a hazardous waste facility permit is received or until the site is closed under RCRA (requiring a post-closure care permit). Interim Status sites are regulated under 40 CFR Part 265 and 6 CCR 1007-3, Part 265.

Waste management units that received hazardous wastes after November 19, 1980 require RCRA closure plans. In addition, those land disposal units which received hazardous wastes after July 26, 1982 (regulated units) are also subject to RCRA interim status groundwater monitoring requirements prior to closure, and post-closure care requirements subsequent to closure. The regulated units are described in detail in the RCRA, Post-Closure Care Permit Application (1988).

There are 3 regulated units at the RFP, all of which are operating under interim status. The use of these units is to cease and the sites will be investigated and remediated as required by the IAG. A RCRA Post-Closure Care and Permit Application for the land disposal units being phased out has been submitted to the CDH and EPA for review and approval (EG&G, 1991a).

The **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)** of 1980 [42 USC §§ 9601, et seq., as amended, 1986] requires the identification, characterization, and cleanup of inactive hazardous waste sites by responsible parties and imposes certain response and reporting requirements for operations from which hazardous substances have been released. While RCRA establishes a regulatory program for present hazardous waste activities, CERCLA establishes a response program for past hazardous waste activities (Anderson and others, 1990). CERCLA requires that remedial actions be pursued at all sites listed by EPA on the National Priorities List (NPL). In 1984, the RFP was proposed for testing to determine whether the site should be placed on the NPL; that Superfund Site listing became final in 1989. CERCLA expressly applies to Federal facilities, including the RFP. CERCLA requires the EPA to design a remedial action "that is protective of human health and the environment, that is cost-effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable." The standards governing the remedial action are drawn from other sources, such as the Clean Water Act, the Safe Drinking Water Act, or State law. These standards are set forth in Section 121 of CERCLA. For sites on the NPL, the requirements are that all legally applicable, relevant, and appropriate requirements (ARARs) of federal environmental laws, and those requirements contained in state environmental laws that are more stringent than federal ARARs, must be applied to remedial actions at federal sites. The ultimate selection of cleanup standards is discretionary and involves a determination by Federal, State, and local regulations of what requirements are appropriate for remediation of the site. In other words, virtually any federal or state law dealing with ground water, surface water, or drinking water may be considered a regulatory requirement under CERCLA. The EPA is charged with the implementation of remedial actions under CERCLA.

CERCLA was revised in 1986 by the Superfund Amendments and Reauthorization Act (SARA) [42 USC § 9607]. SARA extended CERCLA's applicability to ongoing treatment, storage, and disposal facilities as well as to abandoned sites. SARA contains a Federal siting policy. SARA also contains a freestanding act, "Emergency Planning and Community Right-to-Know Act" (EPCRA) of 1986 [42 USC §§ 11001, et seq.]. This act requires local and Federal governments

to prepare emergency response plans and disclose the manufacture or use of hazardous chemicals (Anderson and others, 1990).

Parties are to enter into negotiations for an Inter-Agency Agreement (IAG) between themselves and the EPA, pursuant to CERCLA Section 120, as amended by SARA 1986.

The Federal Water Pollution Control Act of 1972 (originally the Water Quality Improvement Act of 1970) was renamed the **Clean Water Act (CWA)** in 1977 [33 USC §§ 1251, et seq., as amended, 1988]. The purpose of this act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA divides pollution into point and non-point sources. Point sources are subjected to a two-level reduction standard that seeks to force the adoption of effluent reduction technology and reduce consideration of costs. The primary regulatory mechanism for reducing point-source pollution is through the requirement of a National Pollutant Discharge Elimination System (NPDES) permit. NPDES will soon apply to the off-site discharge of stormwater (EG&G, 1991b). EPA regulations promulgated under the CWA are contained within 40 CFR Parts 100 through 400, the majority occurring within Parts 121 through 125.

Pollutants are defined in the CWA as dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into waters. However, the Supreme Court ruled that radioactive materials were not a "pollutant" within the meaning of the CWA, even though the definition of pollutant included "radioactive materials," because such a classification may result in duplication of the Atomic Energy Commission's (and its successor, the Nuclear Regulatory Commission's) functions (Anderson and others, 1990). Because the Act's definition of "waters" does not specifically include aquifers, EPA relies on the Safe Drinking Water Act to regulate discharges and encourages states to develop underground injection control programs (Arbuckle and others, 1989).

Non-point sources, such as siltation caused by surface-water run-off, require behavior adjustments in land use activities. Only point sources are subject to NPDES; however, the CWA exempts all NPDES permits from NEPA except for sewage treatment plant grants and new source discharge permits.

The National Oil and Hazardous Substance Pollution Contingency Plan (NCP) established reporting requirements for spills. These requirements were first enacted as part of the Water Quality Improvement Act of 1970, which became the Federal Water Pollution Act of 1972 before being renamed the Clean Water Act of 1977. These requirements were amended in 1978 and have been supplemented by CERCLA and EPCRA (Title III of SARA) (Arbuckle and others, 1989).

The EPA or states with approved programs issue NPDES permits that control and limit discharge. Currently, EPA's Region VIII office in Denver issues and administers the permit for RFP (EG&G, 1991b).

The **Water Quality Act (WQA)** of 1987 (codified in scattered sections of 33 USC §§ 1251, et seq.) made changes in the CWA, but left the basic structure of the Act untouched. The WQA extends the deadlines for compliance with a variety of effluent limitations and allows modifications, subject to relatively strict standards, of some best available technology (BAT) requirements. The Act also permits a limited modification of water quality limitations. Congress addressed the subject of ocean dumping, imposed increased treatment requirements, and attempted to reduce the amount of toxic pollutants dumped into municipal sewage systems (Anderson and others, 1990).

Water quality standards are set by the State, acting pursuant to the procedures set out in 40 CFR Section 131.20. Although the EPA issues guidance documents about the effects of various pollutants, it does not set specific minimums for State standards. EPA rules require that such standards specify and protect appropriate water uses, like water supply, fish, wildlife; and set specific numerical criteria where possible to attain these ends. The State standards must attain

the CWA's goal of fishable, swimmable waters wherever attainable, and, at a minimum, must maintain the uses designated in the standards and current uses, unless the state can demonstrate that the designated use is unattainable or infeasible for some reason.

The **Colorado Water Quality Control Act (CWQCA)** of 1973 [CRS §§ 25-8-101, et seq., as amended 1982 and Supp. 1988) created the Water Quality Control Commission to create or change water quality standards and stream classifications. Under CWQCA, the State has the authority to establish use classifications and water quality standards to protect the "waters of the State" for their established uses as well as the authority to issue state versions of NPDES discharge permits to non-Federal facilities with specific discharge limits and monitoring requirements. The Commission may establish state-wide or site-specific standards.

The CDH Regulations [5 CCR 1002-3 through 7] implement CWQCA. The State of Colorado has the authority to issue permits for discharges of pollutants to surface waters pursuant to the CWA and the CWQCA. CDH Water Quality Control Division administers the State NPDES program. Colorado does not currently have the authority to issue NPDES permits for federal facilities including the RFP; therefore, it is written by the EPA. However, the State is required to promulgate stream standards for the waters of the State and these stream standards are generally incorporated into the Federal NPDES permit for the RFP by the EPA. The State of Colorado is also required to certify that any NPDES permits issued by the EPA for Federal facilities comply with Colorado stream standards.

The **Safe Drinking Water Act (SDWA)** of 1974 [42 USC §§ 300, et seq., as amended 1986] authorized the EPA to promulgate regulations that protect the Nation's public drinking water supplies and subsurface waters (DOE, 1988). This Act required EPA to set national drinking water standards for contaminant levels, created a program for states to regulate underground injection wells, and provided for protection of sole-source aquifers. Regulations are contained within 40 CFR Part 141 (Arbuckle and others, 1989).

The **Colorado Water Rights Laws** of 1973 [CRS §§ 37-80-120(3) and 37-92-305(5)] affect the use of surface water. Such use is governed by the doctrine of prior appropriation. The first person to put water to a beneficial use has a senior right to that water over the right of any other person, often referred to as, "first in time, first in right." For example, the most senior water user on a stream may use all of its water if there is only enough water in the stream to serve the needs of that user. However, a senior water user cannot change the amount of water used or the location at which that water is diverted if that change will injure the existing water rights of other water users (including those with junior water rights). The Colorado legislature, in the Water Rights Determination and Administration Act of 1969, created a system for determining when a change in the use of a water right would injure other water users (CRS §§ 37-92-101, et seq.). Someone who intends to alter the use of water on a stream must either demonstrate to a Colorado water court that the proposed change will not injure other water users, or develop a plan of augmentation to make up any water lost to other water users.

At the RFP, some of the proposed surface water management activities may change the use of water on the stream segments flowing through the Plant. Therefore, the RFP may need to obtain water court approval for some of these activities (EG&G, 1991b).

The **Clean Air Act (CAA)** of 1970 [42 USC §§ 7401, et seq., as amended 1977, 1990] federalized air pollution control regulation and made health protection the basis for much of that regulation (Arbuckle and others, 1989). Congress had enacted prior air pollution control legislation in 1963, 1965, and 1967, but it was ineffective. The CAA directs EPA to establish threshold levels for pollutants above which there is a risk to human health. EPA must try to reduce adverse air impacts until those threshold levels are attained. EPA regulations under the CAA are contained within 40 CFR Parts 50, 60, and 80.

The probability of any water management activity becoming a "major source" of air pollution is small. But if toxic substances or radionuclides are released to the air, those impacts may need to be addressed.

The **Colorado Radiation Control Act (CRCA)** of 1989 [CRS §§ 25-11-101, et seq.] provides for the regulation of radioactive materials within the State of Colorado. The management of radioactive materials at the RFP is also governed by the AEA, and therefore many of the requirements of the CRCA may not apply to on-site management of radioactive materials at the RFP. However, this Act will affect the ability of off-site laboratories to analyze samples collected at RFP. The Radiation Control Division of CDH may also offer its opinions concerning the management of radiation at RFP, and of the potential impacts to human health from radioactive surface waters.

In addition to Federal and State Laws, the RFP is also subject to several intergovernmental agreements that require DOE to assure high quality discharges in compliance with the CWA, and to clean up existing contaminated sites. Such agreements include the AIP, the FFCA, and the IAG.

The **Agreement in Principle (AIP)** of June 28, 1989 is the result of the summer 1989 investigatory actions at the RFP (DOE, 1989) and is an extension of a memorandum of understanding that was signed between DOE and Colorado (CDH) in 1979 that initiated monitoring and assessment of terminal ponds prior to discharge. The AIP is intended to assure the citizens of Colorado that any discharges from RFP do not adversely affect public health and safety or the environment.

Existing programs were adopted by the AIP and new commitments by DOE were created. In addition, an independent monitoring program overseen by CDH was authorized (EG&G, 1991b). To achieve the objectives of the AIP, the Parties involved agreed to expand the environmental monitoring under DOE's financial support and to accelerate cleanup of certain sites. The AIP also allows for review of and comment on RFP groundwater and surface water monitoring programs by CDH (DOE and State of Colorado, 1989).

The AIP requires CDH and the municipalities with drinking water supplies immediately downstream of RFP (Broomfield, Westminster, Thornton, and Northglenn) to test for inorganic

and organic chemicals and radionuclides in RFP ponds and their drinking water reservoirs before any water is discharged from the RFP ponds. It is the responsibility of CDH to assess the water quality prior to its discharge. DOE is required to conduct a study of possible methods for eliminating discharges to surface waters at the RFP. This Zero-Offsite Water-Discharge Study is pursuant to this provision of the AIP. Frequent meetings of Plant operators with CDH, EPA, and cities downstream of Rocky Flats to share water quality data are also required. Under the AIP, the State may cause the DOE or its contractors to conduct surface water sampling programs not mandated by existing water quality regulations. Consequently, sampling under the AIP exceeds standard regulatory monitoring practice within the State.

DOE is to provide the State with information associated with releases of hazardous substances and pollutants, conduct an Environmental Compliance audit, and conduct a Waste Minimization audit (DOE and State of Colorado, 1989).

In addition, the Parties were to enter into negotiations for an IAG between themselves and the EPA, pursuant to CERCLA Section 120, as amended by SARA 1986 (DOE and State of Colorado, 1989). The AIP has largely been superseded by the more-comprehensive IAG, signed in January 1991 (EPA, 1991a).

The **NPDES Federal Facilities Compliance Agreement (NPDES FFCA)** of March 25, 1991 is between the DOE and EPA, pursuant to Executive Order 12088. Its purpose is to achieve and maintain compliance with water pollution control standards of the CWA at the RFP. It includes standards for surface water management and contains a plan for compliance with applicable pollution control standards (Compliance Plan), as mandated by Executive Order 12088 (EPA, 1991b). In addition, a complete diagnostic evaluation of the Sewage Treatment Plant (STP) was completed as required by the NPDES FFCA. Subsequent recommendations were incorporated into the Compliance Plan and are being implemented through operating changes and capital equipment projects, as discussed in the Surface Water Management Plan (SWMP) (EG&G, 1991b).

The Interagency Agreement (IAG) of January 22, 1991 is between DOE, the State of Colorado, and the EPA for the purposes of ensuring that RFP environmental impacts continue to be investigated and responded to; facilitating cooperation and information exchange between the Parties; establishing a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions in accordance with applicable regulations; providing a framework for permitting RCRA Treatment, Storage, and Disposal Units; and avoiding litigation between Parties. The IAG also clarifies the roles of the Parties in cleanup of hazardous wastes at the RFP and identifies IRAs and IMs which are appropriate at the RFP prior to the implementation of final remedial actions.

On July 31, 1986, DOE, CDH, and EPA entered into a Compliance Agreement which defined roles and established milestones for major environmental operations and corrective/remedial action investigations for the RFP. It also established requirements for compliance with CERCLA. The Compliance Agreement established a specific strategy which allowed for management of high priority, past disposal areas and low priority areas at the RFP. Through this Compliance Agreement, DOE identified approximately 178 IHSSs and RCRA/CHWA-regulated closure sites, and over 2000 waste generation points.

The IAG lists the IHSSs and their corresponding OUs, LRAs, and Support Regulatory Agencies (SRAs). IHSSs, previously called Solid Waste Management Units (SWMUs), are individual locations on the RFP site where solid wastes, including hazardous wastes, have or may have been placed, either planned or unplanned. The locations of IHSSs are grouped into OUs based on potential threats to human health and the environment and on geographical location.

To minimize the potential for conflicts between agencies, the Parties agreed to recognize an LRA and SRA for each specific OU. The LRA is responsible for primary review and sole approval of all submittals received pursuant to the IAG. The SRA is to provide comments on each submittal to the LRA, which assembles those comments and provides them without editing to DOE. In certain instances, EPA and the State may choose to have a joint lead for a particular OU. Designations of LRA and SRA are only for administering the IAG and do not change the

jurisdictional authorities of the Parties. Where EPA is designated the LRA, the State is the SRA for that OU. Conversely, where the State is the LRA, EPA is the SRA. The designation of the State as LRA for any OU does not constitute "authorization" of any of its actions pursuant to CERCLA Section 122(e)(6). The IAG includes particular tasks related to these duties.

RCRA and CHWA authorize the State to act as LRA for various OUs. At OUs for which EPA has been designated the LRA under CERCLA, DOE is to conduct a detailed ARARs analysis to establish cleanup standards at the RFP, taking into account both Federal and State ARARs. EPA, after consultation with the State, will determine the ARARs to be applied at the Rocky Flats Plant. CDH enters portions of IAG that relate to the RI/FS and to interim and final remedial actions pursuant to CERCLA, RCRA, NEPA, and AEA.

EPA and the State have joint authority to determine the choice of LRA for OUs not identified as of the IAG. DOE is not allowed to dispute such determinations, but EPA and the State agree to consider DOE's technical comments on the appropriateness of either other Party as the LRA or SRA for a particular OU. The Parties agreed that EPA shall be the LRA for additional OUs (identified after IAG) believed to contain purely radioactive substances.

In order to ensure that all contaminants are properly addressed at the Site despite the present regulatory jurisdictional dispute between DOE and the State concerning the regulation of radioactive waste pursuant to RCRA and CHWA, and to avoid any delays in the regulatory process and environmental cleanup due to this dispute, the Parties agreed that for those OUs for which the State is LRA, the State will address both the radioactive and hazardous components of hazardous substances. The Parties also agreed that EPA will impose requirements pursuant to CERCLA on the radioactive waste, the radioactive portion of the mixed waste, or both the hazardous and radioactive constituents of the mixed waste at issue if the radioactive portion cannot be segregated out for that portion of the investigative or response process.

Under the IAG, DOE is to develop and implement IRAs/IMs as required by EPA and the State. EPA and DOE will jointly select the IRA in the IRA/IM decision document; the State will select

the IM. DOE will develop, implement, and report upon RI/RCRA Facility Investigations (RI/RFIs) to investigate the nature and extent of contamination at the Site. DOE will design, propose, undertake, and report upon Feasibility Studies/Corrective Measures Studies (FS/CMSs) to identify alternatives for remedial action/corrective action for OUs at the Site. All OUs are to undergo this RI/RFI and FS/CMS process. For OUs identified at the completion of the FS/CMS stage as containing purely radioactive substances, EPA and DOE will issue a ROD. DOE and EPA, in consultation with the State, will select the remedial action for each OU.

Presidential exemptions from applicable environmental protection standards may be requested under the following Acts, inter alia. (DOE Order 5400.1):

- Clean Air Act, as amended, Section 118(b);
- Clean Water Act, as amended, Section 313(a);
- Safe Drinking Water Act, as amended, Section 1447(b);
- Resource Conservation and Recovery Act, as amended, Section 6001;
- Comprehensive Environmental Response, Compensation, and Liability Act, as amended, Section 120(j)(1); and
- Noise Control Act, as amended, Section 4(b)(2).

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B

APPENDIX B

DATA CAPTURE FORMS FOR PROGRAM ZOWD

Water Management Summary Task 21 (Alternative 0): Temporary Water Storage Capabilities Study

Dimension	Time Element					
	Immediate FY 91		Short-term (5 years)		Long-term (beyond)	
1. Data vs. Action	**Action**		**Action**		**Action**	
2. Technical vs. Polit./Regulatory	**Regulatory**		**Technical**		**Technical**	
3. System Impact (Change in MGY going offsite; plus confidence factor)	Delta MGY	Conf fact (%)	Delta MGY	Conf fact (%)	Delta MGY	Conf fact (%)
3.1 All Water	0	100	-121.5	50	?	
3.2 Total Wastewater	--		-44.1	50		
3.3 Point-source discharges	--		--			
3.4 Sources to groundwater	--		-3.3	50		
3.5 Surface runoff	--		-40.8	50		
3.6 Domestic waste	--		-77.4	50		
3.7 Misc. losses	--		0			
4. Financial Impact	0		12.8 M		?	
5. Environmental Impact	0		6		6	
6. Input from/to Other Tasks (enumerate):	Input from: 6,9,10, 11/13,16		Output to: 5,14,15,17 23,24,26, 27,28,30		10,12,30	
7. Input from WR Plan	--		--		--	
8. Input from Monitoring	--		--		--	

Water Management Summary Task 21 (Alternative 0): Temporary Water Storage Capabilities Study

Reporting Dimensions Supplement
Task Interrelationships

Task Providing Input	System Affected	Relationship	Remarks
11/13	6	A	
8	4	A	
26	4	A	
15	1	A	

Codes:

System Affected:

1. All Water
2. Total Wastewater
3. Point-source Discharges
4. Groundwater
5. Surface Runoff
6. Domestic Waste
7. Miscellaneous Losses

Relationship:

A. MGY Reduction in Input Task Precludes Further Reduction in Present Task
B. Reductions are additive
C. Increase in Input Task Allows Reduction in Present Task
D. Reduction in Input Task Causes Increase in Present Task
E. Other (Explain in Remarks)

Water Management Summary Task 21 (Alternative 1): Temporary Water Storage Capabilities Study

Dimension	Time Element					
	Immediate FY 91		Short-term (5 years)		Long-term (beyond)	
1. Data vs. Action	**Action**		**Action**		**Action**	
2. Technical vs. Polit./Regulatory	**Regulatory**		**Technical**		**Technical**	
3. System Impact (Change in MGY going offsite; plus confidence factor)	Delta MGY	Conf fact (%)	Delta MGY	Conf fact (%)	Delta MGY	Conf fact (%)
3.1 All Water	0	100	-126.3	50	?	
3.2 Total Wastewater	--		-80.7	50		
3.3 Point-source discharges	--		--			
3.4 Sources to groundwater	--		-3.3	50		
3.5 Surface runoff	--		-45.6	50		
3.6 Domestic waste	--		-77.4	50		
3.7 Misc. losses	--		0			
4. Financial Impact	0		91.1 M		?	
5. Environmental Impact	0		6		6	
6. Input from/to Other Tasks (enumerate):	Input from: 6,9,10, 11/13,16		Output to: 5,14,15,17 23,24,26, 27,28,30		10,12,30	
7. Input from WR Plan	--		--		--	
8. Input from Monitoring	--		--		--	

Water Management Summary Task 21 (Alternative 1): Temporary Water Storage Capabilities Study

Reporting Dimensions Supplement
Task Interrelationships

Task Providing Input	System Affected	Relationship	Remarks
11/13	6	A	
8	4	A	
26	4	A	
15	1	A	

Codes:

System Affected:

1. All Water
2. Total Wastewater
3. Point-source Discharges
4. Groundwater
5. Surface Runoff
6. Domestic Waste
7. Miscellaneous Losses

Relationship:

A. MGY Reduction in Input Task Precludes Further Reduction in Present Task
B. Reductions are additive
C. Increase in Input Task Allows Reduction in Present Task
D. Reduction in Input Task Causes Increase in Present Task
E. Other (Explain in Remarks)

Water Management Summary Task 21 (Alternative 2): Temporary Water Storage Capabilities Study

Dimension	Time Element					
	Immediate FY 91		Short-term (5 years)		Long-term (beyond)	
1. Data vs. Action	**Action**		**Action**		**Action**	
2. Technical vs. Polit./Regulatory	**Regulatory**		**Technical**		**Technical**	
3. System Impact (Change in MGY going offsite; plus confidence factor)	Delta MGY	Conf fact (%)	Delta MGY	Conf fact (%)	Delta MGY	Conf fact (%)
3.1 All Water	0	100	-121.5	50	?	
3.2 Total Wastewater	--		-44.1	50		
3.3 Point-source discharges	--		--			
3.4 Sources to groundwater	--		-3.3	50		
3.5 Surface runoff	--		-40.8	50		
3.6 Domestic waste	--		-77.4	50		
3.7 Misc. losses	--		0			
4. Financial Impact	0		16.3 M		?	
5. Environmental Impact	0		6		6	
6. Input from/to Other Tasks (enumerate):	Input from: 6,9,10, 11/13,16		Output to: 5,14,15,17 23,24,26, 27,28,30		10,12,30	
7. Input from WR Plan	--		--		--	
8. Input from Monitoring	--		--		--	

Water Management Summary Task 21 (Alternative 2): Temporary Water Storage Capabilities Study

Reporting Dimensions Supplement
Task Interrelationships

Task Providing Input	System Affected	Relationship	Remarks
11/13	6	A	
8	4	A	
26	4	A	
15	1	A	

Codes:

System Affected:

1. All Water
2. Total Wastewater
3. Point-source Discharges
4. Groundwater
5. Surface Runoff
6. Domestic Waste
7. Miscellaneous Losses

Relationship:

A. MGY Reduction in Input Task Precludes Further Reduction in Present Task
B. Reductions are additive
C. Increase in Input Task Allows Reduction in Present Task
D. Reduction in Input Task Causes Increase in Present Task
E. Other (Explain in Remarks)

C

APPENDIX C

SAMPLE OUTPUT FOR PROGRAM ZOWD

```
    ZOWD PROGRAM OUTPUT FOR SESSION ON  5 Jun, 1991  AT 11:42
    OUTPUT FILE: alt1.out


    Enter the INPUT FILE pathname (ZOWDIN2.DAT):
ZOWDIN2.DAT


    ****  GOAL SETTING PROCESS ****


    The following goals are available:

        1   Absolute Zero-Discharge
        2   Zero Waste Discharge
        3   BAT Treated Waste OK
        4   No point source discharge
        5   No ground water discharge
        6   No storm water discharge

Goals Seek to Maximize/Minimize Discharge Reduction as Follows:

      |-------------------- Objectives ----------------------
Goal  |  All     Waste    Point    Ground   Surface    Dom.
      | Water    Water   Sources   Water    Runoff    Waste

 1      MAX      ---      ---      ---      ---       ---
 2      ---      MAX      ---      ---      ---       ---
 3      ---      MIN      ---      ---      ---       ---
 4      ---      ---      MAX      ---      ---       ---
 5      ---      ---      ---      MAX      ---       ---
 6      ---      ---      ---      ---      MAX       ---

    ## Do you wish to change these, or add a goal? (Y/N)
n

    ## Select a Goal (A number from 1 to  6):
         1

    Please specify a time period for this goal.
        Choices are:
            1  =  Immediate (FY 1991/92)
            2  =  Short-term (Within next five years)
            3  =  Long term (Beyond five years)

    ## Enter Time Period (1 to 3):
         2
    Use Low Cost as an additional objective? (Y/N)
y
    Ignore Task Interrelationships? (Y/N)
n

    There are        27 possible alternative combinations.
    Would you like intermediate results written to disk? (Y/N)
y


        *** PROCESSING BEGINS ***

    Processing Combination:     1
```

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-47.5 MGY
Minimum change with confidence factor:	-23.8 MGY
Approximate Total Cost ($ millions):	12.80
Average environmental impact code (0-10)	6.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-82.9 MGY
Approximate Total Cost ($ millions):	14.47
Average environmental impact code (0-10)	4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 2

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-52.3 MGY
Minimum change with confidence factor:	-26.2 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-85.4 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 3

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-47.5 MGY
Minimum change with confidence factor:	-23.8 MGY
Approximate Total Cost ($ millions):	16.30
Average environmental impact code (0-10)	8.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-82.9 MGY
Approximate Total Cost ($ millions):	17.97
Average environmental impact code (0-10)	5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 4

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-47.5 MGY
Minimum change with confidence factor:	-23.8 MGY
Approximate Total Cost ($ millions):	12.80
Average environmental impact code (0-10)	6.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-82.9 MGY
Approximate Total Cost ($ millions):	14.47
Average environmental impact code (0-10)	4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III: Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 5

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-52.3 MGY
Minimum change with confidence factor:	-26.2 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-85.4 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 6

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67

Average environmental impact code (0-10) 2.00

II. Storm Water

Total change in Offsite Water Discharge: -47.5 MGY
Minimum change with confidence factor: -23.8 MGY
Approximate Total Cost ($ millions): 16.30
Average environmental impact code (0-10) 8.00

Total All Groups

Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -82.9 MGY
Approximate Total Cost ($ millions): 17.97
Average environmental impact code (0-10) 5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups

Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 7

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle

Total change in Offsite Water Discharge: -74.0 MGY
Minimum change with confidence factor: -59.2 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water

Total change in Offsite Water Discharge: -47.5 MGY
Minimum change with confidence factor: -23.8 MGY
Approximate Total Cost ($ millions): 12.80
Average environmental impact code (0-10) 6.00

Total All Groups
Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -82.9 MGY
Approximate Total Cost ($ millions): 14.47
Average environmental impact code (0-10) 4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 8

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle
Total change in Offsite Water Discharge: -74.0 MGY
Minimum change with confidence factor: -59.2 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water
Total change in Offsite Water Discharge: -52.3 MGY
Minimum change with confidence factor: -26.2 MGY
Approximate Total Cost ($ millions): 91.10
Average environmental impact code (0-10) 9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-85.4 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 9

Task 8; Alternative 0

Task 11; Alternative 0

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 0 Process Water Reuse Potential Study
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-74.0 MGY
Minimum change with confidence factor:	-59.2 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-47.5 MGY
Minimum change with confidence factor:	-23.8 MGY
Approximate Total Cost ($ millions):	16.30
Average environmental impact code (0-10)	8.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY

Minimum change with confidence factor: -82.9 MGY
Approximate Total Cost ($ millions): 17.97
Average environmental impact code (0-10) 5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 10

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle
Total change in Offsite Water Discharge: -76.2 MGY
Minimum change with confidence factor: -61.0 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water
Total change in Offsite Water Discharge: -45.3 MGY
Minimum change with confidence factor: -22.7 MGY
Approximate Total Cost ($ millions): 12.80
Average environmental impact code (0-10) 6.00

Total All Groups
Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -83.6 MGY
Approximate Total Cost ($ millions): 14.47
Average environmental impact code (0-10) 4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 11

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-76.2 MGY
Minimum change with confidence factor:	-61.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-50.1 MGY
Minimum change with confidence factor:	-25.1 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-86.0 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 12

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-76.2 MGY
Minimum change with confidence factor:	-61.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-45.3 MGY
Minimum change with confidence factor:	-22.7 MGY
Approximate Total Cost ($ millions):	16.30
Average environmental impact code (0-10)	8.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-83.6 MGY
Approximate Total Cost ($ millions):	17.97
Average environmental impact code (0-10)	5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY

Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 13

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle
Total change in Offsite Water Discharge: -76.2 MGY
Minimum change with confidence factor: -61.0 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water
Total change in Offsite Water Discharge: -45.3 MGY
Minimum change with confidence factor: -22.7 MGY
Approximate Total Cost ($ millions): 12.80
Average environmental impact code (0-10) 6.00

Total All Groups
Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -83.6 MGY
Approximate Total Cost ($ millions): 14.47
Average environmental impact code (0-10) 4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 14

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-76.2 MGY
Minimum change with confidence factor:	-61.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

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II. Storm Water

Total change in Offsite Water Discharge:	-50.1 MGY
Minimum change with confidence factor:	-25.1 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-86.0 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY

Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 15

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle
Total change in Offsite Water Discharge: -76.2 MGY
Minimum change with confidence factor: -61.0 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water
Total change in Offsite Water Discharge: -45.3 MGY
Minimum change with confidence factor: -22.7 MGY
Approximate Total Cost ($ millions): 16.30
Average environmental impact code (0-10) 8.00

Total All Groups
Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -83.6 MGY
Approximate Total Cost ($ millions): 17.97
Average environmental impact code (0-10) 5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 16

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-76.2 MGY
Minimum change with confidence factor:	-61.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-45.3 MGY
Minimum change with confidence factor:	-22.7 MGY
Approximate Total Cost ($ millions):	12.80
Average environmental impact code (0-10)	6.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-83.6 MGY
Approximate Total Cost ($ millions):	14.47
Average environmental impact code (0-10)	4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 17

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-76.2 MGY
Minimum change with confidence factor:	-61.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-50.1 MGY
Minimum change with confidence factor:	-25.1 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-86.0 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 18

Task 8; Alternative 0

Task 11; Alternative 1

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 1 Task 11/13 Selected Alternate, Increase Capac.
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-76.2 MGY
Minimum change with confidence factor:	-61.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-45.3 MGY
Minimum change with confidence factor:	-22.7 MGY
Approximate Total Cost ($ millions):	16.30
Average environmental impact code (0-10)	8.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-83.6 MGY
Approximate Total Cost ($ millions):	17.97
Average environmental impact code (0-10)	5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 19

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-63.8 MGY
Minimum change with confidence factor:	-51.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-57.7 MGY
Minimum change with confidence factor:	-28.9 MGY
Approximate Total Cost ($ millions):	12.80
Average environmental impact code (0-10)	6.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-79.9 MGY
Approximate Total Cost ($ millions):	14.47
Average environmental impact code (0-10)	4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 20

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-63.8 MGY
Minimum change with confidence factor:	-51.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-62.5 MGY
Minimum change with confidence factor:	-31.3 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-82.3 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 21

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-63.8 MGY
Minimum change with confidence factor:	-51.0 MGY
Approximate Total Cost ($ millions):	1.67

Average environmental impact code (0-10) 2.00

II. Storm Water

Total change in Offsite Water Discharge: -57.7 MGY
Minimum change with confidence factor: -28.9 MGY
Approximate Total Cost ($ millions): 16.30
Average environmental impact code (0-10) 8.00

Total All Groups

Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -79.9 MGY
Approximate Total Cost ($ millions): 17.97
Average environmental impact code (0-10) 5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups

Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 22

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle

Total change in Offsite Water Discharge: -63.8 MGY
Minimum change with confidence factor: -51.0 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water

Total change in Offsite Water Discharge: -57.7 MGY
Minimum change with confidence factor: -28.9 MGY
Approximate Total Cost ($ millions): 12.80
Average environmental impact code (0-10) 6.00

Total All Groups
Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -79.9 MGY
Approximate Total Cost ($ millions): 14.47
Average environmental impact code (0-10) 4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 23

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle
Total change in Offsite Water Discharge: -63.8 MGY
Minimum change with confidence factor: -51.0 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water
Total change in Offsite Water Discharge: -62.5 MGY
Minimum change with confidence factor: -31.3 MGY
Approximate Total Cost ($ millions): 91.10
Average environmental impact code (0-10) 9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-82.3 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 24

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-63.8 MGY
Minimum change with confidence factor:	-51.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-57.7 MGY
Minimum change with confidence factor:	-28.9 MGY
Approximate Total Cost ($ millions):	16.30
Average environmental impact code (0-10)	8.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY

Minimum change with confidence factor: -79.9 MGY
Approximate Total Cost ($ millions): 17.97
Average environmental impact code (0-10) 5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Total All Groups
Total change in Offsite Water Discharge: 3.7 MGY
Minimum change with confidence factor: 3.0 MGY
Approximate Total Cost ($ millions): .00
Average environmental impact code (0-10) .00

Processing Combination: 25

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 0

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 0 Temporary Water Storage - New Off-Channel

I. Wastewater Recycle
Total change in Offsite Water Discharge: -63.8 MGY
Minimum change with confidence factor: -51.0 MGY
Approximate Total Cost ($ millions): 1.67
Average environmental impact code (0-10) 2.00

II. Storm Water
Total change in Offsite Water Discharge: -57.7 MGY
Minimum change with confidence factor: -28.9 MGY
Approximate Total Cost ($ millions): 12.80
Average environmental impact code (0-10) 6.00

Total All Groups
Total change in Offsite Water Discharge: -121.5 MGY
Minimum change with confidence factor: -79.9 MGY
Approximate Total Cost ($ millions): 14.47
Average environmental impact code (0-10) 4.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 26

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 1

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
21 1 Temporary Water Storage - Great Western

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-63.8 MGY
Minimum change with confidence factor:	-51.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-62.5 MGY
Minimum change with confidence factor:	-31.3 MGY
Approximate Total Cost ($ millions):	91.10
Average environmental impact code (0-10)	9.00

Total All Groups

Total change in Offsite Water Discharge:	-126.3 MGY
Minimum change with confidence factor:	-82.3 MGY
Approximate Total Cost ($ millions):	92.77
Average environmental impact code (0-10)	5.50

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Total All Groups

Total change in Offsite Water Discharge:	3.7 MGY
Minimum change with confidence factor:	3.0 MGY
Approximate Total Cost ($ millions):	.00
Average environmental impact code (0-10)	.00

Processing Combination: 27

Task 8; Alternative 0

Task 11; Alternative 2

Task 21; Alternative 2

**** Goal Selected is: 1 Absolute Zero-Discharge

Actions which SUPPORT the objectives of this goal are:

11 2 Task 11/13 Selected Alternate, Decreased Capac.
~21 2 Temporary Water Storage - Terminal Ponds

I. Wastewater Recycle

Total change in Offsite Water Discharge:	-63.8 MGY
Minimum change with confidence factor:	-51.0 MGY
Approximate Total Cost ($ millions):	1.67
Average environmental impact code (0-10)	2.00

II. Storm Water

Total change in Offsite Water Discharge:	-57.7 MGY
Minimum change with confidence factor:	-28.9 MGY
Approximate Total Cost ($ millions):	16.30
Average environmental impact code (0-10)	8.00

Total All Groups

Total change in Offsite Water Discharge:	-121.5 MGY
Minimum change with confidence factor:	-79.9 MGY
Approximate Total Cost ($ millions):	17.97
Average environmental impact code (0-10)	5.00

Actions which OPPOSE the objectives of this goal are:

8 0 Present Landfill Area GW/Surf. Water Collection

III. Ground Water

Total change in Offsite Water Discharge:	3.7 MGY

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   Minimum change with confidence factor:        3.0 MGY
   Approximate Total Cost ($ millions):           .00
   Average environmental impact code (0-10)       .00


Total All Groups
   Total change in Offsite Water Discharge:      3.7 MGY
   Minimum change with confidence factor:        3.0 MGY
   Approximate Total Cost ($ millions):           .00
   Average environmental impact code (0-10)       .00



    **** Goal Selected is:  1  Absolute Zero-Discharge


<<<<<The best combination of Tasks for this goal follows>>>>>

   Actions which SUPPORT the objectives of this goal are:

    11  0  Process Water Reuse Potential Study
    21  1  Temporary Water Storage - Great Western

I.   Wastewater Recycle
   Total change in Offsite Water Discharge:     -74.0 MGY
   Minimum change with confidence factor:       -59.2 MGY
   Approximate Total Cost ($ millions):          1.67
   Average environmental impact code (0-10)      2.00

   ~
II.  Storm Water
   Total change in Offsite Water Discharge:     -52.3 MGY
   Minimum change with confidence factor:       -26.2 MGY
   Approximate Total Cost ($ millions):         91.10
   Average environmental impact code (0-10)      9.00


Total All Groups
   Total change in Offsite Water Discharge:    -126.3 MGY
   Minimum change with confidence factor:       -85.4 MGY
   Approximate Total Cost ($ millions):         92.77
   Average environmental impact code (0-10)      5.50


   Actions which OPPOSE the objectives of this goal are:

     8  0  Present Landfill Area GW/Surf. Water Collection

III. Ground Water
   Total change in Offsite Water Discharge:      3.7 MGY
   Minimum change with confidence factor:        3.0 MGY
   Approximate Total Cost ($ millions):           .00
   Average environmental impact code (0-10)       .00


Total All Groups
   Total change in Offsite Water Discharge:      3.7 MGY
   Minimum change with confidence factor:        3.0 MGY
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Approximate Total Cost ($ millions):          .00
Average environmental impact code (0-10)      .00


Evaluation Complete.  New Goal? (Y/N):
n
```

D

APPENDIX D

AGREEMENT IN PRINCIPLE BETWEEN THE UNITED STATES DEPARTMENT OF ENERGY AND THE STATE OF COLORADO

AGREEMENT IN PRINCIPLE

Between the United States Department of Energy
and the State of Colorado

THIS AGREEMENT is entered into this 28th day of June, 1989, between the United States Department of Energy (DOE) and the State of Colorado. It reflects the understanding and commitments between the parties regarding DOE's provision to Colorado of additional technical and financial support for state activities in environmental oversight, monitoring, remediation, emergency response and health-related initiatives associated with the Rocky Flats Plant (RFP) and the acceleration of cleanup activities where contamination may present an imminent threat to health or the environment.

This Agreement is designed to assure citizens of Colorado that the health, safety and environment are being protected through accelerated existing programs and substantial new commitments by DOE, and through a vigorous program of independent monitoring and oversight by Colorado officials. These agreements are described in Amendment No. 4 to the Mutual Cooperation Agreement (MCA) between DOE and the State of Colorado, and in the Attachments thereto, all of which are incorporated herein by reference. The five Attachments are:

Attachment A:	Monitoring
Attachment B:	DOE Cleanup Initiatives
Attachment C:	DOE Action Items
Attachment D:	Health-Related Initiatives
Attachment E:	DOE Financing for State Environmental Monitoring and Health Related Studies

In order to achieve the objectives of the agreement, the parties hereto agree to amend their Mutual Cooperation Agreement as follows:

1. Attachment A outlines an expanded environmental monitoring system for the RFP, for which DOE will provide financial support. This additional monitoring is required to assure the safety of citizens in the review of the facility.

2. DOE will pursue accelerated cleanup of certain RFP contamination sites and sources as described in Attachment B, and as required by state and federal law. Such cleanup efforts will commence in 1989, and be accelerated to achieve earlier cleanup pursuant to applicable regulations.

3. DOE will pursue the additional initiatives described in Attachment C. The general intent of these DOE action items is to achieve a more comprehensive and integrated environmental management system at RFP. DOE will report regularly on progress of these items to Colorado.

4. DOE will provide additional funds to Colorado as defined in Attachment D. DOE will provide resources, as defined in Attachments D and E, to Colorado to implement these initiatives. Colorado will form a Rocky Flats Health Advisory Panel consisting of medical, technical, public health and other representatives of local, state and federal agencies, including the United States Environmental Protection Agency (EPA), Colorado Department of Health (CDH), DOE, Rocky Flats Environmental Monitoring Council (RFMC) and members of the surrounding communities. The Health Advisory Panel will advise the Governor of Colorado and CDH and will recommend to them and to participating agencies the types and methodologies of studies necessary to determine human health effects.

5. DOE agrees to comply fully with all applicable state and federal environmental laws.

6. DOE will provide additional funds to Colorado as defined in Attachment E and in Amendment No. 4 to the MCA. These funds are being provided to allow Colorado to provide a greater level of assurance that compliance with federal and state environmental laws is being achieved and maintained on a continuing basis at the RFP. Such additional independent oversight, monitoring and surveillance is necessary to assure a high degree of protection for citizens and the environment of Colorado.

7. The parties hereto shall enter into good faith negotiations for an Interagency Agreement between themselves and the EPA, pursuant to Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986. The Interagency Agreement shall not diminish the responsibilities and authorities of the parties as expressed in the July 31, 1986, Compliance Agreement between the parties hereto and EPA or the responsibilities and obligations pursuant to law contained in this Agreement.

8. This Agreement and Attachments hereto will in no way diminish the authority of Colorado to fully carry out its statutory and regulatory responsibilities under state and federal law.

9. Any funds provided to Colorado under this Agreement are federal funds to be transferred to and administered exclusively by the CDH.

10. Should new federal, state or community issues arise that are necessary to protect public health or the environment, DOE and Colorado will promptly commence discussions to modify this Agreement for their inclusion.

NOW, THEREFORE, the parties hereto have signed this Agreement in recognition of their pledge of mutual best efforts to achieve

these ends through cooperation and negotiation in good faith in accordance with the understandings as set forth above.

Roy Romer
Governor of Colorado

Date: June 28, 1989

Admiral James Watkins
Secretary of Energy

Date: June 28, 1989

Attachment A

MONITORING

These are monitoring activities which are underway or which require immediate action to reassure citizens that their air and drinking water is safe. The state also will convene an independent panel to review monitoring system results and needed improvements. The DOE will support and provide resources for the following independent monitoring and verification activities.

A. Surface Waters and Treated Drinking Waters

1. Municipal Drinking Water

- The Colorado Department of Health (CDH) is working with the four municipalities of Broomfield, Westminster, Thornton and Northglenn, in their ongoing sampling of all organic chemicals (including the 15 unique chemicals found in the November analyses by EPA) and of radionuclides.

- In consultation with local government, CDH will develop a program for increasing the frequency of independent analyses of these drinking waters.

2. Samples of Stream Reservoir Quality

- The CDH is working with the municipalities and EPA in monitoring the quality of the reservoirs used for drinking water (Standley and Great Western reservoirs) by taking periodic samples for all organic chemicals (including the 15 unique chemicals) and for radionuclides.

3. Samples of On-Site Discharges

- Before any discharges from on-site ponds occur, the DOE will provide a full set of samples for organic chemicals and radionuclides. Periodic biomonitoring tests also will be performed. These samples will be split with EPA and/or CDH and will provide the basis for CDH to determine the safety of such discharges.

- The CDH will work with EPA in developing an independent sampling plan for all on-site discharges to surface waters.

B. Ground-Water Monitoring

- The CDH, in cooperation with EPA and the local municipalities, will review the current ground-water monitoring system and will recommend needed improvements. The analysis will include examination of the location, depth, sampling practice and quality of all wells.

- The CDH, in cooperation with EPA and the local municipalities, will continue regular monitoring of ground-water data.

- The CDH will sample existing boundary wells to determine if any contamination has moved to the plant boundaries.

- The DOE will expedite implementation of ground-water monitoring system improvements identified by CDH and EPA. This will include installation of over 50 additional wells in the remainder of 1989.

C. Air Quality Monitoring

- The DOE will submit a comprehensive air emissions inventory for CDH review.

- The DOE will provide a comprehensive materials balance of VOCs for CDH review.

- The DOE will identify all the toxic and radioactive emissions coming from the facility (stacks, vents, ponds, etc.) and will support CDH in the use of an accepted emissions model to predict any areas of off-site impact.

- DOE will conduct promptly the stack testing necessary to verify the amount and type of emissions.

- The DOE will install continuous emission monitors in all appropriate sources to ensure continuous compliance with air pollution requirements.

- CDH will prepare a comprehensive review, in cooperation with EPA and local governments, of the air monitoring system and will implement needed improvements to the air quality monitoring network.

- CDH will deploy VOC ambient monitors offsite, as necessary.

Attachment B

ACCELERATED CLEANUP OF PAST ENVIRONMENTAL CONTAMINATION

Several past disposal sites on the plant pose a high risk for further spread of contaminants into surface water, ground water and the soil. The following contaminated sites require special and accelerated actions by the DOE. Such actions will be done in full compliance with state and federal environmental laws:

881 Hillside

DOE will initiate ground-water cleanup by September 1989, or as soon as the regulatory process will allow. DOE will continue to accelerate ground-water cleanup actions at the 881 Hillside until the potential threat to off-site water is eliminated. DOE shall commit additional funds to assess and cleanup heavy metals and radioactive constituents that are present in the ground water.

DOE will expedite full implementation of final remediation of the contamination sources in order to bring the site into compliance with state and federal environmental restoration standards.

Mound, East trench, 903 pad

DOE will expedite completion of the assessment of ground-water contamination and will initiate ground-water cleanup by January 1990, or as soon thereafter as the regulatory process will allow. DOE will conduct cleanup action to prevent the migration of hazardous and radioactive constituents in ground water, soils and the air, including radioactive materials and heavy metals.

DOE will expeditiously commence full implementation of final remediation of the contaminated sources as required by state and federal regulations.

Solar ponds

In order to stem the flow of harmful contaminants into ground water and soil, DOE will expedite the cleanup of the solar evaporation ponds by removal of sludge from the remaining ponds and shipment of all the pondcrete by October 1991. Such activities are necessary to remove the sources of contamination, including the removal of soil, water and sludge.

Other Priority Sites

Numerous other inactive waste sites remain uninvestigated or tested for the potential of off-site contamination. DOE shall accelerate the cleanup of all other sites that are identified as a threat to public health or the environment.

Off-site Contamination

DOE will initiate a new review of the off-site soils and lake sediments contamination. This analysis should reassess the extent and nature of radioactive contamination and recommend remedial action strategy options for public comment and review.

Attachment C

DOE ACTIONS

- Information on hazardous or radioactive releases: DOE agrees to expeditiously provide all information to the state associated with releases of hazardous substances, pollutants, contaminants and radioactive materials from the facility.

- DOE auditing of the facility: DOE will expand regulatory and safety compliance personnel at the facility. DOE will develop a new Rocky Flats office that increases direct communication with DOE headquarters and substantially increases DOE official oversight, auditing and safety compliance activities at the plant. DOE will report to the Governor with organization strategy by July 1, 1989.

- Q-Clearances: Expedite handling of Q-clearance process for forthcoming applications by state officials.

- Office for State and EPA officials: Establish an office space on the plant grounds for state and federal monitoring personnel. This facility should provide office and communication space for daily use by state officials. A temporary facility should be available in June 1989.

- Environmental compliance audit: DOE is conducting a comprehensive environmental compliance audit of all activities that have environmental impacts and will review performance and compliance with all existing state and federal environmental laws. DOE will report to the Governor, the Colorado Department of Health and the Rocky Flats Monitoring Council by September 1989.

- Waste minimization audit: DOE is conducting a facility-wide waste minimization audit that recommends how existing hazardous and radioactive materials can be reduced in use, volume or eliminated from plant operation. DOE will report to the Governor by December 1989.

- Source Reduction and Zero Discharges Study: Conduct a study of all available methods to eliminate Rocky Flats discharges to the environment including surface waters and ground water. This review should include a source reduction review.

- Background Studies: DOE is conducting a "background characterization" of ground water and soils on and near the plant site to determine the base level of naturally occurring radioactive and hazardous constituents. It will submit a draft water report, based on available data, to the Colorado Department of Health by the November 1, 1989, and a draft soil report by December 30, 1989.

- Increase Waste Characterization: Update and revise the plant's current waste-characterization plan. Expand and provide more detail on the nature, quantities and hazard associated with all hazardous, mixed hazardous and radioactive and solely radioactive wastes in use on the plant site. Provide a status report to the Colorado Department of Health by September 30, 1989, and completion of a draft report by September 1990 with periodic updates.

- Low-level mixed waste disposal plan: Develop a plan for low-level mixed waste treatment and disposal. Currently, DOE has no plan for the ultimate treatment or off-site disposal of low-level mixed wastes. This report should recommend how the facility intends to manage this type of wastes and provide a draft report to the Colorado Department of Health by November 30, 1989.

- Supercompactor: Expedite delivery and operation of the proposed supercompactor. DOE should prepare the necessary permit information to expedite approval by the State of Colorado.

- Document Availability: Make available all DOE or Rockwell documents or reviews that address safety and environmental compliance concerns. Such documents should be provided promptly to the Rocky Flats Environmental Monitoring Council, the Colorado Department of Health and other organizations, consistent with the classification requirements reflected in this Attachment. It is understood that selected Q-cleared employees of the state will not be barred by the need-to-know policy from access to documents or information that relate to safety or environmental health concerns.

- Access for state inspectors: State officials with a Q-clearance should be granted access to records and buildings to determine environmental compliance, without prior announcement, except in cases where safety precautions are necessary. Implement new policy by July 1, 1989.

- Need to Know policy: Clarify and provide written explanation to the Governor's Office and the Colorado Department of Health the current "need-to-know" security information policy that precludes state and local access to certain types of information at the plant.

- Incinerator Restart: Inform the state in advance of plans to restart the 771 incinerator or other major sources of incineration. DOE should provide state officials with access to the incinerator prior to startup and during operations.

- Incineration Data: Provide the state will all information pertinent to the operation of incinerators including a daily log of all material being placed in them.

- Emissions Data: Provide monthly data of all emissions from vents and stacks.

- Compliance with cleanup milestones: Cleanup and closure plans for all past contaminated sites should be in compliance with state and EPA milestones and deadlines.

- Regular Progress Reports: Provide monthly reports to the State of Colorado regarding the status of the facility.

Amendment D

ROCKY FLATS HEALTH STUDIES

The following are the elements of Rocky Flats health-related studies:

1. Toxicological review
2. A dose reconstruction
3. A quantitative risk assessment
4. Other epidemiological/health studies
5. Activities of the independent panels
6. Support for cancer and birth defects registries

In general, the state believes the following activities are needed:

I. STEP ONE

A. Assemble Panel I, write Request For Proposals (RFP) and select contractor:

The first step will be the formation of a panel (Panel I) to establish the parameters of a toxicologic review and dose reconstruction study to be accomplished by the RFP. Panel I will consist of:

1. Scientists from radiation epidemiology, radiation dosimetry, health physics, environmental toxicology, statistics, environmental transport, and risk assessment backgrounds;

2. Representatives from the Colorado Department of Health;

3. Other individuals/agencies representing these areas of expertise. Panel I will consist of seven members of which two will be from Colorado. The panel will be selected in consultation with DOE.

Product: A panel representative of national and local expertise and local interests, an RFP that adequately describes the scope of work to be accomplished and selection of a contractor capable of completing the tasks defined in the RFP.

Timeframe: Three months, beginning August 1989.

B. Assemble Panel II.

Purpose: The purpose of this panel is to provide oversight for all Panel I contractor activities. This second independent panel, consisting of approximately 15 people, will be formed by the DOH in consultation with the Colorado Department of Energy, the Rocky

Flats Environmental Monitoring Council and others to review the findings of the toxicological review, dose reconstruction and quantitative health risk assessment, to verify the credibility of the information, and to determine the feasibility of further health-related studies. The panel will consist of: (a) scientists from radiation epidemiology, radiation dosimetry, health physics, environmental toxicology, statistics, environmental transport and risk assessment backgrounds, (b) representatives from the Colorado Department of Health, (c) other individuals/agencies representing those areas of expertise, and (d) community representatives.

Product: A panel heavily dependent upon the diverse expertise represented by Colorado citizens but also others in the areas described above, a series of meetings through that panel members become informed about and have the opportunity to discuss/critique activities of the Panel I contractor, a document summarizing the panel's critique of contractor work to date.

Timeframe: Entire length of process, beginning October 1989.

II. STEP TWO

These studies will be carried out by the Panel I independent contractor and, hence, all cost estimates are very approximate. Funding will be sufficient to cover costs as proposed by the Panel I contractor.

A. Studies to be done by contractor

1. Toxicologic review

Purpose: A toxicologic review is required to provide a basic level of knowledge about the variety of hazardous substances that have been used at the plant and to which residents may have been exposed.

This step will consist of an investigation of the radionuclides and chemicals of interest and will include:

(a) Identification of radionuclides and chemicals that have been on the plant site since 1952, and/or have been identified on or off-site to ensure that a complete inventory has been compiled;

(b) Ascertainment of the quality and the quantity of the available sampling data.

(c) Preparation of a literature review of the toxicologic information on the substances of interest. The Panel I contractor will be responsible for reporting progress of this work on a regular and timely basis to Panel II.

Product: A series of meetings during which Panel II is informed about the work of the Panel contractor as work is progressing and an opportunity to discuss/critique these findings, a document summarizing the Panel I contractor's findings, a second document summarizing Panel II's comments on the work done and findings of the Panel I contractor.

Timeframe: One year, beginning November 1989.

2. Dose reconstruction

Purpose: This study will determine the levels of and potential avenues by which hazardous substances (both radionuclides and chemicals) could have been or can be released from the boundaries of the plant.

The reconstruction would include exposure doses, exposure pathways and the demography of the surrounding area. The time span to be studied is 1953 to the present. The dose reconstruction would be used later to conduct a quantitative health risk assessment for Rocky Flats and the surrounding area and would help determine the feasibility of future studies.

Product: A series of meetings with Panel II, in which the panel members are updated on dose reconstruction activities and have an opportunity to discuss/critique Panel I contractor's work, a document summarizing the findings of the dose reconstruction activities, and a document summarizing the panel's critique of Panel I contractor activities and findings.

Timeframe: One and one-half years, beginning in May 1990.

III. STEP III

A. Reassemble or reconstitute Panel I to write a second RFP that will propose a quantitative health-risk assessment.

B. Studies to be conducted through the second RFP:

1. Quantitative health risk assessment.

Purpose: A quantitative health-risk assessment is important to determine the potential risks posed by the plant to the surrounding population. The quantitative health risk assessment will be based in part on the data compiled during the toxicologic review and dose reconstruction. The risk assessment will ascertain the level of risk of residents in the area surrounding the plant. This would include health risks from both radionuclides and chemicals identified on-site and off-site.

Product: A quantitative, level 3 risk assessment, including hazard identification, dose response, exposure assessment and risk characterization, based in part on the toxicologic review and dose reconstruction completed previously, a series of meetings with Panel II to describe health risk assessment activities in progress, and a document that summarizes the panel's critique of the health-risk assessment activities conducted under the second RFP.

Timeframe: One year, beginning May 1991, to June 1992.

2. Other studies as determined by Panel II

Purpose: After three years of studies, Panel II will conclude its review of the findings of the toxicologic review, dose reconstruction, and quantitative risk assessment and will make recommendations on whether to proceed with health-related studies. It must be understood that there are reasons other than scientific reasons for a recommendation in support of further health studies.

Product: A document summarizing the Panel's recommendations concerning health-related studies.

Timeframe: Six months, beginning June 1992.

IV. ONGOING RESEARCH

In addition to the above-mentioned studies, the state must maintain an ongoing level of involvement in assessing the impact of the plant on the surrounding populations. The state and DOE must show that they are fully apprised of the potential health effects during the period the plant continues to operate. Toward this end, the following activities are necessary:

8. Contribution to the state's cancer/birth defects databases.

Colorado currently operates a database for cancer and birth defects for comparison with levels found in the general population. DOE will contribute funds to support the databases for studies in the vicinity of the facility.

Product: Maintenance of statewide cancer and birth defects registries at levels that are capable of supporting quality health investigations.

Timeframe: Five years, beginning October 1989.

B. Risk communication.

CDH will perform an extensive health-risk communication initiative based on the results of the toxicologic review, dose reconstruction and quantitative health risk

Product: A mechanism through which information concerning the toxicologic review, dose reconstruction, risk assessment and recommendations concerning further health-related studies can be effectively communicated to the general public.

Attachment E
Revised 6/28/89

DOE FINANCING FOR STATE ENVIRONMENTAL MONITORING AND OVERSIGHT AND HEALTH-RELATED STUDIES

I. INITIAL UPFRONT EXPENSES

A. Special Projects

Update emergency response plan	$100,000
Evaluate environmental monitoring program	30,000
Review maximum credible accident	20,000
TOTAL	$150,000

B. Equipment and Supplies

Air quality control	$ 10,000
Radiation control	10,000
Hazardous materials and waste management	20,000
Water quality control	10,000
Laboratory equipment	425,000
Emergency response	105,000
TOTAL	$580,000

TOTAL UPFRONT EXPENSES	$730,000

II. ONGOING ANNUAL EXPENSES - STATE FY90-94 (July 1, 1989 - June 30, 1994)

A. Air Quality Control Division

On-site inspections, ambient monitoring of VOCs, compliance evaluation, modeling verification of VOC's emissions impacts, oversight of DOE stack tests and CEM installation and operations	$135,000
Off-site ambient air monitoring of VOCs at three locations plus split VOC tests of stack emissions	230,000
Equipment and travel	10,000
TOTAL	$375,000

B. Environmental Epidemiology and Disease Control Division

Environmental toxicology support for all environmental activities in regulatory and cleanup decisions	$ 85,000
Management and coordination of all health-related activities per Attachment D	65,000
TOTAL	$150,000

C. Hazardous Materials and Waste Management Division

Review of CERCLA activities particularly cleanup of 881 Hillside, 903 Pad, Mound and Trenches, and Solar Evaporation Ponds	$170,000
Review of RCRA activities - waste treatment and storage inspections, compliance, corrective actions, environmental audit, etc.	260,000
Ground-water monitoring program, both on-site and off-site locations	70,000
TOTAL	$500,000

D. Radiation Control Division

Monitor and analyze radioactive emissions and generation, use, haulage, storage, and disposal of radioactive plant and review WIPP and low-level radioactive waste disposal initiative	$ 75,000
Increased radiation monitoring of air, surface water, ground water and soils	115,000
TOTAL	$190,000

E. Water Quality Control Division

Perform oversight data analysis, stream classification evaluations, permit review, and 401 certification	$ 75,000
Drinking water - confirm quality in public water systems	15,000
Equipment and travel	15,000
Surface water monitoring and data analysis	60,000
Ground-water modeling and data management	55,000
TOTAL	$220,000

F. Laboratory Division

Staff support	$ 50,000

G. Emergency Response Activities (CDH and DODES)

CDH - enhance coordination and capabilities for response to possible incidents involving hazardous or radioactive material from Rocky Flats Plant	$ 60,000
DODES - update the emergency response plan for RF, improve communications, public information, training and exercises	85,000
TOTAL	$145,000

H. Coordination and Information Exchange

Increase public understanding of waste management and cleanup activities at the plant and coordinate various CDH activities related to Rocky Flats	$160,000
Update environmental monitoring program annually	15,000
TOTAL	$175,000

TOTAL ANNUAL EXPENSES	$1,805,000
III. HEALTH-RELATED INITIATIVES - First Year (See Attachment D)	$700,000

6/28/89

AMENDMENT NO. 4 TO MUTUAL COOPERATION AGREEMENT
BETWEEN THE STATE OF COLORADO AND
THE UNITED STATES DEPARTMENT OF ENERGY
FOR THE ROCKY FLATS PLANT
(No. DE-FC04-79AL11209)

THIS AMENDMENT NO. 4, entered into and effective this 28th day of June, 1989, is by and between the United States of America represented by the United States Department of Energy ("DOE"), and the State of Colorado, represented by the Colorado Department of Health ("CDH").

WHEREAS, DOE and CDH entered into the above-referenced Mutual Cooperation Agreement ("Agreement") effective May 16, 1979, for a period of three years and extended the Agreement for additional three-year periods, effective May 16, 1982; May 16, 1985; and May 16, 1988; and

WHEREAS, the parties desire to extend the term of the Agreement through September 30, 1994; and

WHEREAS, the parties desire to amend the Agreement to provide additional DOE funds to CDH for its increased level of effort for the following: (1) environmental monitoring and oversight of the air, water and soil on or around the Rocky Flats Plant; (2) increased state activity and DOE financial support for emergency preparedness activities; (3) increased CDH efforts in the areas of coordination, public education and information exchange; and (4) environmental epidemiology and other health-related initiatives; and

WHEREAS, as a result of such increased level of financial support, CDH agrees to provide: (1) reports to DOE on the results of such monitoring and analysis; (2) advice and recommendations to DOE in emergency response matters; and (3) periodic reports to DOE on CDH's public education and information exchange efforts and other health-related initiatives; and

WHEREAS, the parties desire to amend the Agreement in certain other particulars as noted herein.

NOW, THEREFORE, the parties agree as follows:

ARTICLE 1 - "SCOPE OF AGREEMENT" IS AMENDED BY THE ADDITION OF THE FOLLOWING ITEMS:

5. Colorado Department of Health (CDH) and Division of Disaster Emergency Services (DODES) shall: (1) update the emergency response program for the Rocky Flats Plant; (2) conduct training jointly with DOE for local governments which could be affected by an emergency at the Plant; and (3) assist local and statewide emergency

response authorities with respect to possible incidents involving hazardous or radioactive materials from the plant. DOOES shall provide periodic reports to CDH and DOE on these activities and, from time to time, advice to DOE on plant operations which may have an impact on the state's emergency response program.

6. CDH shall: (1) establish a Rocky Flats Coordinator within CDH whose function shall be to coordinate activities of the various CDH divisions with regard to the Plant; (2) increase its efforts for better public understanding of issues involving the Rocky Flats Plant, including coordination with local governments; (3) evaluate and interpret health information associated with environmental releases at the Rocky Flats Plant by providing personnel with expertise in environmental epidemiology and public health; (4) increase overall coordination; and (5) review material and documents relating to the update or revision to the Maximum Credible Accident defined for the plant. CDH shall provide periodic reports to DOE of its activities in these areas.

7. CDH shall: (1) prepare a plan for the state's environmental monitoring and analysis of hazardous and radiological materials which may be present in the air, water and soil on or around the Rocky Flats Plant; such plans shall be provided to DOE for review and consultation; (2) provide DOE the opportunity to split samples taken; and (3) provide periodic reports to DOE on the results of said plan.

8. DOE will provide funding to CDH to purchase equipment described in Attachment E. CDH may determine that in lieu of such funding, it is more appropriate for DOE to loan such equipment to CDH. The parties agree that any new field instruments and emergency response supplies and materials which may be loaned by DOE to CDH shall be maintained and safeguarded in accordance with the Article III, entitled "Government Property" hereto.

ARTICLE II - "PAYMENT" IS AMENDED BY THE ADDITION OF THE FOLLOWING SECTIONS:

1.a In consideration of the performance by the state of its responsibilities hereunder and in support of its increased cooperative assistance programs, DOE will pay the state the sum of One Million Eight Hundred Five Thousand Dollars ($1,805,000) per year over the term of this Amendment No. 4. The allocation of such total funds shall be as described in Attachment E, DOE Financing for State Environmental Monitoring and Oversight and Health-Related Studies. The total amount shall be paid in monthly installments, without invoice, on the first day of the month commencing July 1, 1989, and continuing through June 30, 1994, unless this Agreement is amended or terminated by mutual agreement. The parties agree that these funds are in addition to the $8,333.33 allocated in Amendment No. 3.

1.b Additionally, DOE will pay Seven Hundred Thirty Thousand Dollars ($730,000) to CDH for one time costs described in Attachment E. Such payments will be made in two installments of Two Hundred Thousand Dollars ($200,000) on July 1, 1989, and Five Hundred Thirty Thousand Dollars ($530,000) on October 15, 1989.

1.c Additionally, DOE will provide Seven Hundred Thousand Dollars ($700,000) to CDH to begin the activities described in Attachment D, Health-Related Initiatives. Such payments will be made in four quarterly installments beginning July 1, 1989. DOE will provide continuing annual funding for the term of this Agreement for the birth defects and tumor registries, operations of the health advisory panel and risk communication initiatives in the amount of Three Hundred Thousand Dollars ($300,000) per year in quarterly installments as described above. DOE will also provide additional resources, subject to congressional appropriations, to conduct the health-related initiatives recommended as necessary by the Health Advisory Panel, of which DOE will be a member, and approved by the Governor and the Secretary of Energy.

3. CDH and DODES agree: (a) to use and apply the funds provided hereunder for the purpose of helping to defray: (i) their personnel operating, travel and support costs for those employees who engage in the performance of work required by this Agreement, (ii) their cost to purchase or maintain the equipment utilized under this Agreement, and (iii) the costs of any consultants employed who are required to perform some of the work hereunder; and (b) that such costs shall include salary and benefits of such employees including related administrative costs.

ARTICLE III - "GOVERNMENT PROPERTY" IS AMENDED BY THE ADDITION OF THE FOLLOWING ITEMS:

4. The Government property shall be used only in connection with this Agreement and, upon written approval by DOE, other state programs; said approval shall not be unreasonably withheld.

NOTE: ALL OF THE FOLLOWING IS ADDED:

6.a CDH shall not be liable for any loss of or damage to the Government property, or for expenses incidental to such loss or damage, except that CDH shall be responsible for any such loss or damage (including expenses incidental thereto): (i) which results from the willful misconduct or lack of good faith on the part of any of CDH's directors, managers, supervisors, or other equivalent representatives who have supervision or direction of all or substantially all of CDH's operations relating to the activities described in this Agreement; or (ii) which results from a failure on the part of CDH, due to the willful misconduct or lack of good faith on the part of any of CDH's directors, managers, supervisors or other equivalent representatives mentioned in (i) above, (aa) to maintain and administer, in accordance with standard practice, the

program for utilization, maintenance, repair, protection and preservation of Government property, as required above, or to take all reasonable steps to comply with any appropriate written directions of DOE, as required above, or (bb) to establish, maintain and administer, as indicated above, a system for control of the Government property.

6.b Upon the happening of loss or destruction of, or damage to, the Government property, CDH shall notify DOE thereof and shall take all reasonable steps to protect the Government property from further damage, separate the damaged and undamaged Government property, put all of the Government property in the best possible order, and furnish to DOE a statement detailing: (i) the loss, destroyed and damaged Government property; (ii) the time and origin of the loss, destruction or damage; and (iii) all known interests in commingled property of which the Government property is a part.

6.c Unless CDH is responsible for the loss, destruction or damage to the Government property, DOE shall make repairs, renovations, or replacements of the damaged Government property or take such other action as DOE deems proper.

6.d If CDH is responsible for the loss, destruction or damage to the Government property, DOE shall make repairs, renovations or replacements of the damaged Government property or take such other action as DOE deems proper, provided CDH bears the cost of such repairs, replacements or renovations.

6.e If CDH is indemnified, reimbursed, or otherwise compensated for any loss of destruction of or damage to the Government property, CDH shall use the proceeds to repair, renovate or replace the Government property involved or shall otherwise reimburse DOE.

6.f CDH shall do nothing to prejudice the Government's right to recover against third parties for any such loss, destruction or damage, and upon request of DOE, shall, at DOE's expense, furnish to DOE all reasonable assistance and cooperation (including assistance in the prosecution of suits and the execution of instruments of assignment in favor of the United States) in obtaining recovery.

ARTICLE VII - "APPROPRIATED FUNDS" IS AMENDED BY THE ADDITION OF THE FOLLOWING:

The parties agree to the extent provisions of this Agreement call for the expenditure of appropriated funds, that such provisions shall be subject to the availability of funds appropriated by the Congress which DOE may legally spend for such purposes.

ARTICLE VIII - "TERMS AND AMENDMENTS" IS AMENDED BY THE ADDITION OF THE FOLLOWING ITEMS:

1. The Agreement, as amended, shall continue in effect through September 30, 1994, and may be extended if mutually agreed by the parties.

2. The parties agree that they will review the terms, activities and funding levels of the Agreement on an annual basis to determine if any modifications are necessary.

3. The parties agree that the purpose of this Agreement is to establish and implement a monitoring program as set forth herein. Nothing in this Agreement shall affect the rights, obligations or duties of the parties as may be provided by law and nothing in this Agreement shall be construed to prohibit the parties from using the information developed under this Agreement in furtherance of their statutory duties, rights and obligations.

ARTICLE IX - CONCENTRATION GUIDES

Monitoring activities and analyses shall be governed by applicable state and federal standards and practices and by the concentration guides and levels set forth in paragraph 4 of the Memorandum of Understanding between the state and DOE and all amendments to said paragraph 4 and the attached "Concentrations in Air and Water Above Background."

All other terms and conditions of the Agreement shall be and remain in effect.

IN WITNESS WHEREOF, the parties have executed this Agreement this 28th day of June, 1989.

THE UNITED STATES OF AMERICA
By: U.S. DEPARTMENT OF ENERGY

By: Admiral James Watkins
Admiral James Watkins,
Secretary of Energy

STATE OF COLORADO, ACTING
BY AND THROUGH THE COLORADO
DEPARTMENT OF HEALTH

By: Tom Looby for
Thomas M. Vernon, Jr., M.D.,
Executive Director

DRAFT

Attachment 1-A

CONCENTRATIONS IN AIR AND WATER ABOVE NATURAL BACKGROUND

In July 1988, the Department of Energy (DOE) published tables of internal and external ionizing radiation dose conversion factors to be used by its facilities in calculating potential radiation dose to the public and in determining compliance with current DOE radiation protection standards for the public (US88a, US88b). These dose conversion factors are based on the recommendations of the International Commission on Radiological Protection (ICRP) in their publication Nos. 26, 30 and 48. The incorporation of ICRP publication No. 48 recommendations regarding internal radiation dosimetry for transuranic nuclides resulted in changes to the calculated Department of Energy Derived Concentration Guides (DCGs) for plutonium and americium isotopes that are of interest for Rocky Flats Plant activities. DCGs are the concentrations which would result in an effective dose equivalent of 100 mrem from one year's chronic exposure or intake of the radionuclide.

Attached are the current calculated Derived Concentration Guides for plutonium-238, -239, -240, -241 and -242, as well as for americium-241. In calculating these DCGs, the methodology prescribed by DOE in a 1985 memorandum has been followed (St86). For calculation of air inhalation DCGs, DOE assumes that the exposed individual inhales 8,400 cubic meters of air at the calculated DCG during the year. Ingestion DCGs assume a water intake of 730 liters at the calculated DCG for the year. In order to achieve a more restrictive DCG, all rounding of calculated DCGs was down to one significant figure.

References:

US88b DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," U.S. Department of Energy, Assistant Secretary for Environment, Safety and Health, July 1988.

St86 Stearn, R.J. Director, "Preparation of Annual Site Environmental Reports for Calendar Year 1986," DOE memorandum, Office of Environmental Guidance, February 28, 1986.

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DOE CALCULATED DERIVED CONCENTRATION GUIDES
USING DOS CONVERSION FACTORS FROM DOE/EH-0071

AIR INHALATION

Radionuclide (Lung Clearance Class)		DCG (pCI/m3)
Pu-238	(W)	0.02
	(Y)	0.02
Pu-239,-240	(W)	0.02
	(Y)	0.03
Pu-241	(W)	1
	(Y)	2
Pu-242	(W)	0.02
	(Y)	0.03
Am-241	(W)	0.02

WATER INGESTION

Radionuclide (GI Absorption Fraction)		DCG (pCi/l)
Pu-238	(1.0E-3)	30
	(1.0E-5)	2,000
Pu-239,240	(1.0E-3)	30
	(1.0E-5)	2,000
Pu-241	(1.0E-3)	1,000
	(1.0E-5)	100,000
Pu-242	(1.0E-3)	30
	(1.0E-5)	2,000
Am-241	(1.0E-3)	30

NOTE: The preceding calculated DCGs are based on an annual radiation protection standard of 100 mrem/year effective dose equivalent, an inhalation rate of 8,400 liters/year, and ingestion rate of 730 liters/year, and dose conversion factors from DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," U.S. Department of Energy, Assistant Secretary for Environment, Safety and Health, July 1988. Calculated DCGs were rounded down to one significant figure.