APPLICATION

for

Washington State Site Certification

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

HANFORD NUMBER TWO

1100 MW NUCLEAR POWER PLANT

JANUARY 1971

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1100 MW NUCLEAR POWER PLANT

JANUARY 1971

THERMAL POWER PLANT SITE
EVALUATION COUNCIL
820 E. Fifth Avenue
Olympia, Washington 98501

BEFORE THE

STATE OF WASHINGTON

THERMAL POWER PLANT SITE EVALUATION COUNCIL

APPLICATION FOR CERTIFICATION

FOR

HANFORD NUMBER TWO

NUCLEAR POWER PROJECT

WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

130 Vista Way
Kennewick, Washington

No. 1

BEFORE THE STATE OF WASHINGTON

THERMAL POWER PLANT SITE EVALUATION COUNCIL

In the Matter of the Application of the	)	THERMAL POWER PLANT SITE APPLICATION
	)	
WASHINGTON PUBLIC POWER SUPPLY SYSTEM, A municipal corporation.	)	No. TPPSEC 71-1
	)	

Request is hereby made by the Washington Public Power Supply System, a municipal corporation of the State of Washington, (hereinafter sometimes referred to as the "Supply System") for approval of the below described location (hereinafter referred to as the "Site") for a thermal power plant, pursuant to Chapter 45, Laws of 1970, Extraordinary Session and the provisions of Chapter 463 of the Washington Administrative Code.

I. PROPOSED PLANT SITE

The official legal description, zoning and other characteristics of the Site are set forth in Section 010 annexed hereto. The Site is located within the United State's Atomic Energy Commission's 559 square mile Reservation in Benton County, Washington, approximately 12 miles north of the City of Richland.

Natural physical characteristics of the proposed Site which indicate that the area is ideally situated for and suited to construction of the proposed thermal power plant include: favorable geographical, geological and seismological characteristics; adequate water supply; ideal climatological characteristics; and remoteness from population centers or areas of special ecological concern. At the same time the proposed Site is in close proximity to major substations and transmission facilities of the Bonneville Power Administration. The proposed plant can utilize existing communications and security systems as well as existing fire protection systems, radiation protection systems, radioactive waste disposal facilities and training and education facilities which are located on or near the AEC Reservation in Benton County. Additionally, the proposed Site can be served by existing research and special medical facilities and environmental and life sciences laboratories which have been established in the area to serve the nuclear industrial complex which has been developed in the area. Finally, there is widespread public acceptance within the communities of the Tri-City area composed of a population which is highly skilled in all phases of engineering, construction and operation of a wide variety of nuclear facilities.

The Site area has served as a nuclear industrial center since 1943 when it was selected by the federal government as the location for construction of one of the world's first nuclear production reactors. Since 1943 nine plutonium production reactors and a number of test reactors have been constructed and operated at the Hanford Reservation. At the same time unprecedented experience and data concerning environmental and ecological factors which are relevant to construction and operation of the Supply System's proposed nuclear power plant have been acquired and are available to the Supply System, with respect to the Site proposed herein.

II. PROPOSED POWER PLANT, TYPE, SIZE AND NATURE OF FUEL

The proposed Washington Public Power Supply System Nuclear Project No. 2, hereinafter referred to as the "Project" consists of a conventional nuclear electric generating plant utilizing either a pressurized water, a boiling water, or a gas cooled type reactor, complete with nuclear steam supply system, turbine generator, nuclear fuel and all accessories and associated facilities and structures, together with transformation, switching and transmission facilities designed to deliver the Project's output to the Bonneville Power Administration's transmission system at its 500 kv Hanford switching station.

The Project will be the No. 4 power plant of the Ten Year Hydro-Thermal Program sponsored by the utilities of the region in cooperation with Bonneville Power Administration.

The Project's net plant output will range from 1,050 to 1,225 Mwe depending on the type of reactor and method of cooling. The Project will be located near the Columbia River and will utilize a cooling pond as a means of cooling the plant and will withdraw only the required make-up water from the River.

The Project fuel will be uranium, thorium, or plutonium oxide or a combination thereof.

III. DESCRIPTION OF ASSOCIATED FACILITIES AND TRANSMISSION LINES

All transformation and switching facilities associated with the Project will be located within the Atomic Energy Commission's Reservation in Benton County, Washington. A 500 kv transmission line will carry the energy generated by the Project to the Bonneville

Power Administration's Hanford 500 kv switching station which is located on the Reservation in Benton County, Washington. Further details concerning the approximate routing, as well as conceptual design and type of the proposed associated transmission lines, is set forth in Section 010(4) included herein.

The entire output of the Project will be distributed by the Bonneville Power Administration within the Federal Columbia River Power System pursuant to agreements between the Bonneville Power Administration, the Washington Public Power Supply System and the 94 consumer-owned utilities which are the purchasers of the energy to be generated by the Project.*

IV. THE WASHINGTON PUBLIC POWER SUPPLY SYSTEM

The Washington Public Power Supply System is a joint operating agency and a municipal corporation of the State of Washington organized pursuant to Chapter 43.52 of the Revised Code of Washington as amended. The Supply System is composed of eighteen Public Utility Districts and the City of Richland, all located within Washington State. Pursuant to Chapter 43.52 of the Revised Code of Washington, the Supply System is empowered to acquire, construct and operate plants and facilities for the generation and/or transmission of electric power.

The management and control of the Supply System is vested in a Board of Directors made up of one representative from each of the nineteen member utilities. Current member utilities and representatives on the Board of Directors and the officers of the Board are as follows:

* *See the "Official Statement" (Exhibit 4) for identity and locations of the Participants.*

BOARD OFFICERS & DIRECTORS	UTILITY MEMBERS
Officers	
Edwin W. Taylor, President	Mason County PUD #3
Howard Prey, Vice President	Douglas County PUD
Alvin E. Fletcher, Secretary	Clallam County PUD
Directors	
Thomas E. Black	Benton County PUD
Kirby Billingsley	Chelan County PUD
Edward J. Fischer	Clark County PUD
Frank Jaeger	Cowlitz County PUD
Oliver R. Pooler	Ferry County PUD
Glenn C. Walkley	Franklin County PUD
John L. Toevs	Grant County PUD #2
Jack J. Stein	Grays Harbor County PUD
Harold W. Jenkins	Kittitas County PUD
Gerald C. Fenton	Klickitat County PUD
Ted R. Teitzel	Lewis County PUD
E. Victor Rhodes	Pacific County PUD #2
Ross B. Shepeard	Skamania County PUD
William G. Hulbert, Jr.	Snohomish County PUD
Andrew Fudge	Wahkiakum County PUD
Walter J. Shipman	City of Richland

An Executive Committee composed of five members elected by the Board of Directors administers the business of the Supply System between regular quarterly meetings of the Board in accordance with rules adopted by the Board and the Executive Committee. The Executive Committee members and utilities represented by each are as follows:

EXECUTIVE COMMITTEE MEMBERS	UTILITIES
Edward J. Fischer - Chairman	Clark, Skamania, Klickitat PUDs
Glenn C. Walkley - Vice-Chairman	Franklin, Benton, Chelan, Douglas, Ferry, Grant, Kittitas PUDs and City of Richland
Frank Jaeger - Secretary	Cowlitz & Wahkiakum PUDs
Jack J. Stein	Grays Harbor, Lewis, Clallam, Mason & Pacific PUDs
William G. Hulbert, Jr.	Snohomish PUD

Other Supply System Projects

The Supply System presently owns and operates the 860 megawatt Hanford Electric Generating Plant which is also located on the Hanford Reservation in Benton County, Washington. This generating plant, also known as "Hanford No. 1", utilizes byproduct steam energy produced by the New Production Reactor ("NPR") to generate electric power. The energy generated by Hanford No. 1 is subscribed for by seventy-six participants, both consumer-owned and investor-owned utilities of the Pacific Northwest. Hanford No. 1 was financed by Supply System Revenue Bonds in the sum of $122 million which were issued in 1963, of which approximately $78,145,000 are presently outstanding.

The Supply System also owns and operates the Packwood Lake Hydroelectric Project under Federal Power Commission License No. 2244 located near the town of Packwood, in Lewis County, Washington. The Packwood Project has a rating of 31.5 megawatts and commenced commercial operation in 1964.

Official Office

The Supply System has its principal office in Kennewick, Washington. The name, title, post office address and telephone number of the person to whom correspondence in regard to this application shall be addressed is as follows:

Mr. Owen W. Hurd, Managing Director
Washington Public Power Supply System
P. O. Box 6510, Kennewick, Washington 99336
Tel: Area Code 509 - 783-6141

V. ATTACHMENTS AND ENCLOSURES

Pursuant to Chapter 4.63.12 of the Washington Administrative Code, "Guidelines for Applicants Seeking Thermal Power Plant (Site)

Certification", the Supply System submits herewith the following sections as a part of and in support of this application:

Section 010 — General Data setting forth plans and information as required by Section 463.12.010 of the Washington Administrative Code, including subsections 1 through 8 as follows:

(1) Legal land description
(2) Water requirements
(3) Transportation
(4) Routing and concept of associated transmission facilities
(5) Plans for satisfaction of existing statutory criteria of State agencies having legal authority over conditions and activities related to the Site
(6) Inventory of historical and archaeological sites
(7) Construction schedule flow chart
(8) Financial studies

Section 015 — Health and safety consisting of plans and information prescribed by Section 463.12.015 of the Washington Administrative Code

Section 020 — Quality of the environment - Land, consisting of information and plans prescribed by Section 463.12.020 of the Washington Administrative Code

Section 025 — Quality of the environment - Water, consisting of plans and information prescribed by Section 463.12.025 of the Washington Administrative Code

Section 030 — Quality of the environment - Air, consisting of plans and information prescribed by Section 463.12.030 of the Washington Administrative Code

Section 035 — Quality of the environment - Natural Resources, consisting of information, proposals and plans prescribed by Section 463.12.035 of the Washington Administrative Code

Section 040 — Quality of the environment - Esthetics, consistent with Section 463.12.040 of the Washington Administrative Code

Section 045	Quality of the environment - Recreation, consisting of proposals regarding recreation consistent with Section 463.12.045 of the Washington Administrative Code
Section 050	Economics - Finances, consisting of economic feasibility studies, financing and related information required by Section 463.12.050 of the Washington Administrative Code.

The list of references and related bibliography are attached at the end of the above listed Sections and the Exhibits are included separately following the last Section.

VI. FILING FEES

The Supply System tenders herewith the sum of Twenty Five Thousand Dollars ($25,000.00) in payment of filing fees as required by Section 7 Chapter 45, Laws of 1970, Extraordinary Session.

NOW, THEREFORE, The Washington Public Power Supply System hereby requests the Council to conduct hearings and issue its recommendation to the Governor of the State of Washington that a certificate be issued approving the Site described herein for construction of a thermal power plant pursuant to Chapter 45, Laws of 1970, Extraordinary Session; (Title 80 of the Revised Code of Washington.)

Applicant further requests that notices of all proceedings herein be given to the Supply System at its address below stated and to its attorneys at the addresses indicated below.

Dated this 28th day of January, 1971 at Kennewick, Washington.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
130 Vista Way
P. O. Box 6510
Kennewick, Washington 99336

By Owen W. Hurd
Owen W. Hurd
Managing Director

Richard Q. Quigley, Counsel
130 Vista Way
P. O. Box 6510
Kennewick, Washington 99336

Houghton, Cluck, Coughlin & Riley
Attorneys
320 Central Building
Seattle, Washington 98104

HANFORD NO. 2

SITE APPLICATION

ERRATA NOTICE

At the time of initial filing of the Hanford No. 2 Site Application, all information that was available to the Supply System on January 28, 1971 was included in the Application.

Since the initial filing there have been five (5) supplemental filings reflecting the additional information gathered since January of 1971. The initial filing included only white pages; supplemental filings of July 1 and August 20 are on yellow pages; and supplemental filings of September 27, October 12 and November 12 are on green pages. Each supplemental page is dated.

If there is a conflict between concepts or statements made on separate filings, the most recent filings will supersede as it reflects the most recent engineering design developments and studies or is responding to the Council's concerns and requests for clarification.

Although some pages of the initial filing and early supplements have been entirely superseded they have been retained in the application for purposes of comparison and the convenience of the Council.

The purpose of the following errata is to identify those numbers, words, paragraphs and pages which are no longer applicable and have been superseded by the later supplements or may require correction for other reasons.

December 28, 1971

ERRATA

010 (1a) - Page 2:

Legal description on this page is further defined by the description provided on page 5 of Exhibit 5.

Pages 3 and 4:

Both pages superseded by page 5. All information on these two pages is no longer applicable with the one exception of the first sentence of paragraph 3 which introduces Figure 010-2.

010 (2) - Page 1:

Superseded by pages 2 and 3. Disregard page 1.

010 (4) - Page 3, Line 1:

Delete "...(Revised July 1, 1971)"

010 (5) - Page 4, Paragraph E:

"Board and Department of Health" should read "Department of Social and Health Services".

Chapter 248.108 WAC for Registration of Reportable Radiation Sources should read 248.116.

010 (5) - Page 5, Paragraph H:

Add beginning sentence, "The Radiation Control Agency is included as a part of Health Services Division under Paragraph "E" above".

010 (5) - Page 9, Lines 12 and 17:

Change Section 101 (5)(G) to read Section 010 (5)(E).

010 (6) - Page 6, Line 5:

Delete "...(Revised July 1, 1971)"

010 (8) - Pages 3-5:

Dr. Ernest O. Salo (Biologist) should be added to the list of consultants.

Figure 010-5:

Contains a number of misspelled town names, i.e., Hermiston, Pendleton, Milton-Freewater, Meacham, Mabton, Waitsburg, Moxee City and Orondo. Refer to Figure 015-2 for correct spelling.

015 (2) - Page 3, First paragraph heading:

"Personal" should read "Personnel".

015 (4) - Page 3-8:

Revised and superseded by pages 17-22. Disregard pages 3-8.

015 (4) - Page 12:

Table 014 (4)-2 should read 015 (4)-2.

015 (4) - Page 14, Line 4:

"300 feet" should read "3000 feet".

015 (4) - Page 19:

Table 015 (4)-1 (Revised): Column headed "Stations" should read "No. of Stations".

020 (1) - Page 2, Line 3:

Delete "7/1/71" and add "of" after "filing".

020 (1) - Page 3

Add to bottom of page "Supp. filing 10/12/71".
Last line: "Filings 7/1/71 and 8/20/71" should read "filing of 9/27/71".

025 (1a) - Page 1, Line 2:

"a cooling pond" should read "mechanical draft dooling towers".

Delete paragraph 3.

025 (1a) - Page 2, Paragraph 2, Line 3:

"Figure 010-11" should read "Figure 010-10".

025 (1a) - Page 3, Outfall Facility, Line 2:

"5,500 gpm" should read "6500 gpm".

025 (1b) - Page 2, Line 6:

Delete the word "evaporation" at the end of the line.

025 (2a) - Page 1:

Revised and superseded by pages 2-5. Delete paragraph 2 of page 1.

025 (2a) - Page 2:

Standard for Toxic, Radioactive or Deleterious Material Concentrations should read "shall be below those of public health significance, or which may cause acute or chronic toxic conditions in the aquatic environment as revealed by bioassay with appropriate organisms, or which may adversely affect other water uses."

Standard for Aesthetic Values, line 2: "...material of their..." should read "...material for their..."

025 (2a) - Page 3, Line 14:

"5,500 gpm should read "6500 gpm".

025 (2b) - Page 1:

Superseded by pages 2-10. Disregard page 1.

025 (2b) - Page 5:

Line 5 - Delete word "approximately".
Line 6 - "7.7 X 10^9" should read "7.88 X 10^9".
Line 7 - "Figure 010-11" should read "Figure 010-10".

12/28/71

025 (2c) - Page 1:

Superseded by pages 2-4. Disregard page 1.

025 (2c) - Page 3:

First sentence under Dispersion Characteristics should read "The jet discharge for a blowdown rate of 6,500 gpm (14.5 cfs) will result in an exit velocity of approximately 7 fps."

025 (2c) - Page 4, Line 2:

Change the word August to September.

025 (2d) - Page 1:

Superseded by pages 2-4. Disregard all but last paragraph on page 1.

025 (2d) - Page 2, Line 14:

Section 025 (2)(b) should be 025 (2)(e).

025 (2e) - Page 7, Line 9:

Correct "cfs" to read "fps".

025 (2g) - Page 7, Line 5 from bottom:

Correct word "rank" to "tank".

Page 8: "on container" should be "container".

Figure 025-5:

On right side of page change the outlet from DEMINERALIZER from "To Cooling Pond" to "To Circulating Water Blowdown Line".

030 (1) - Page 1, Line 4:

Change "tested on a weekly basis and routinely tested under Load Conditions approximately on a quarterly basis" to read "tested a minimum of once a month for two hours of operation".

030 (1) - Page 2:

Second paragraph: "435,000 gallons per year" should be "523,000 gallons per year".

Fourth line from bottom: Insert the word "treatment" after "Flue gas..."

030 (2) - Pages 1-6

Superseded by pages 7-13. Disregard pages 1-6.

030 (4) - Page 12:

Tornado on June 16, 1948 has been reclassified as a "funnel cloud" by Hanford Meterological Station.

035 (1a) - Page 1, Third line from bottom:

"a cooling pond: should read "mechanical draft cooling towers".

Bottom line: Delete "...or into diffusion wells, cribs or troughs".

035 (2c) - Page 2, Line 3:

Change the word "litigation" to "mitigation".

050 (1a) - Page 1:

Next to last paragraph superseded by terms of lease, as provided in Exhibit 5. Delete "...for an agreed annual payment for a 99 year term."

050 (1d) - Page 3:

Superseded by pages 4-7. Disregard page 3.

Exhibit 1:

Insert date of D. G. Williams' letter to O. W. Hurd at head of first page, Nov. 25, 1970.

Section 010

General

INTRODUCTION

The following Sections are submitted pursuant to the "Guidelines for Applicants Seeking Thermal Power Plant Certification", Chapter 463.12 of the Washington Administrative Code. The sections are numbered to conform to numbers of the "Guidelines" and subsections are in turn numbered in order to identify with the particular section of each particular guideline.

Guidelines (WAC)	Section	Titles
463-12-010	010	GENERAL
463-12-015	015	HEALTH & SAFETY
463-12-020	020	LAND
463-12-025	025	WATER
463-12-030	030	AIR
463-12-035	035	NATURAL RESOURCES
463-12-040	040	AESTHETICS
463-12-045	045	RECREATION
463-12-050	050	ECONOMICS-FINANCES

The Sections make reference to exhibits which are compiled at the back of this volume. These "Exhibits" are numbered in the order to which reference is made in the above Sections.

All "Figures" referred to in the text are located at the end of each Section.

The Supply System's proposed Hanford No. 2 is a nuclear electric generating plant having a nominal electric power output of 1100 Mw. The plant will consist of a boiling water reactor, a turbine-generator, an evaporative cooling tower system, a pumphouse which takes makeup water from the Columbia River, a 500-kilovolt transmission line leading to the Bonneville Power Administration substation 18 miles northwest, and other associated facilities required for the generation of electric power.

Nuclear System

The nuclear steam supply system (NSSS) employed consists of a boiling water type reactor and the necessary auxiliary systems required to control, contain and service the nuclear core. The system is rated at 3330 megawatts (thermal).

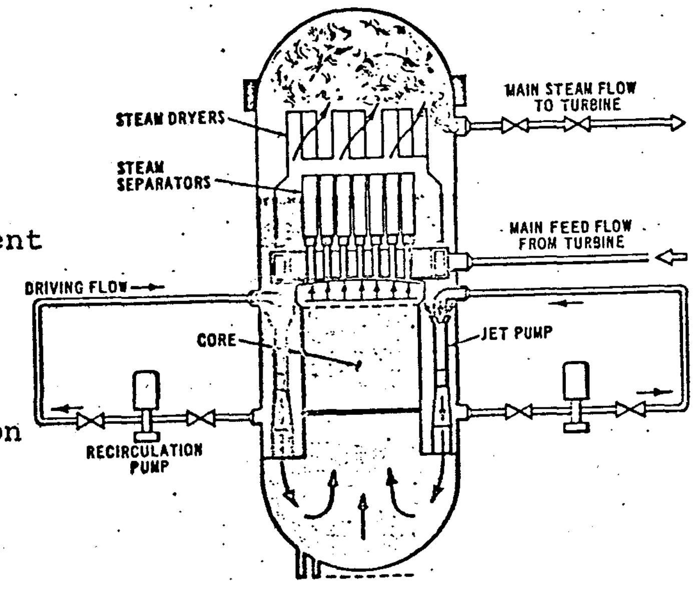
A reactor vessel houses the nuclear core from which the energy required to produce steam is derived. This energy is controlled by hydraulically activated control rods. The reactor core consists of an array of fuel assemblies cooled by water and steam. The steam that is produced in the core is separated from the reactor water and subsequently dried in the top of the vessel prior to exit from the vessel. Cooling of the core is accomplished by a forced recirculation system consisting of jet pumps located in the peripheral area around the core inside the reactor which receive their motive power from two externally located motor driven centrifugal pumps which draw a fraction of the reactor water from the vessel and return it with increased pressure to the jet pumps. (See Figure inset)

The reactor is controlled at a nearly constant pressure. During normal operations, the steam admitted to the turbine is controlled by the turbine initial pressure regulator which maintains essentially constant pressure at the turbine inlet, thus controlling the vessel pressure. The integration of the turbine pressure regulator/control system and the reactor recirculation flow control system permits the quantity of steam being produced to respond automatically to the turbine demand.

The nuclear system is supported by the specialized functions of its auxiliary systems. The major auxiliary systems used for normal operation are:

- Reactor Water Cleanup System
- Residual Heat Removal System
- Fuel Pool Cooling and Filtering System
- Cooling Water Systems
- Radioactive Waste Disposal Systems

Other auxiliary systems are provided as backup or emergency systems to ensure safe shutdown of the reactor during any design basis accident including those resulting from natural phenomenon such as earthquakes, tornados, and floods.



STEAM AND RECIRCULATION WATER FLOW PATHS

To ensure that radioactive material releases are minimized and to provide the maximum protection to the nuclear system, a multi-barrier containment design is utilized. This design includes four (4) levels of protection to the fuel.

The first level of protection is the fuel barrier which consists of the zircaloy fuel cladding surrounding the uranium oxide fuel pellets. The fuel cladding is designed to retain integrity as a radioactive material barrier throughout the design power range. The fuel cladding will accommodate, without loss of integrity, the pressures generated by fission gases released.

The second level of protection is the nuclear system process barrier consisting of the reactor vessel and all attached piping and isolation valves. This barrier is designed to isolate the vessel and maintain core cooling during and after design bases accidents.

The third level of protection is the primary containment system which includes the containment vessel that houses the reactor vessel and the balance of the primary system. This barrier is designed to suppress the energy released and to limit the releases of radioactive material during postulated design basis accidents.

The fourth level of protection is the secondary containment system including the reactor building which houses the nuclear system including the previously listed barriers. This barrier is designed to isolate and control the release of fission products to the environs during and after hypothetical postulated accidents which are discussed in the Preliminary Safety Analysis Report.

Isolation of the barrier is accomplished by closing the building ventilation dampers and maintaining a negative pressure in the building thereby controlling the release of radioactive material to the environs.

The four (4) level containment barrier design assures that the radioactive releases during both normal and accident conditions are below the established AEC regulations for nuclear power plants.

In addition to the multi-barrier containment design discussed above, a sophisticated radioactive waste disposal system is provided to assure that radioactive material releases are well below established limits. This system processes, recycles and/or disposes of those wastes generated during normal routine and non-routine operations. The wastes processed are of three types, (1) gaseous, (2) liquid and (3) solid.

Offsite exposure due to release of radioactivity in gaseous wastes is kept as low as practicable by allowing almost all of the radioactivity to decay before release to the atmosphere. The gaseous wastes are generated in the reactor and carried over to the main condenser by the steam flowing through the turbine. These radioactive gases are removed from the condenser by an air evacuation system which discharges the gases through a recombiner system which removes the entrained free oxygen and hydrogen. The remaining air/gas mixture flows through a 30-minute holdup piping system and subsequently through a charcoal adsorber system where the radioactive gases are held up prior to release. These releases are below the AEC guidelines as established in 10CFR20 and as proposed in 10CFR50 Appendix I.

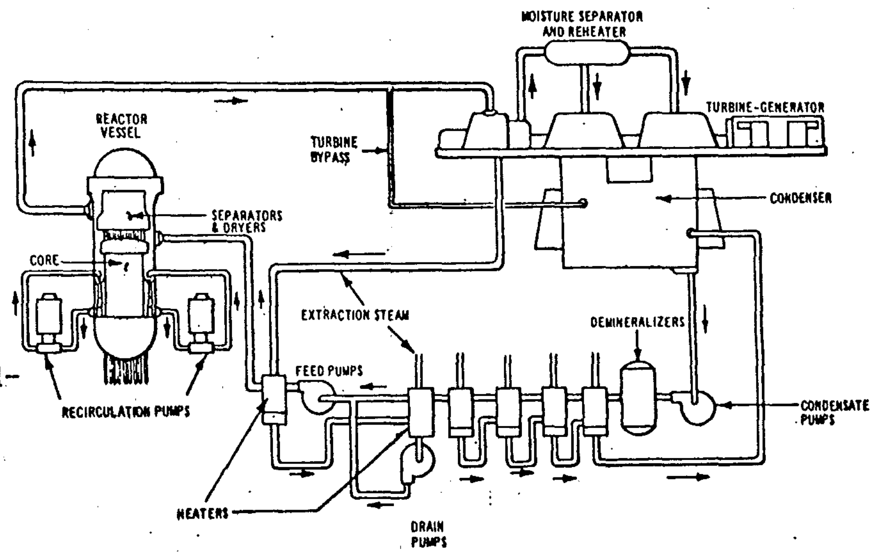
Most so-called "liquid wastes" are aqueous streams containing radionuclides which must be removed by processes such as filtration, evaporation and demineralization prior to reuse of the water within the plant. This processing converts almost all of the radioactivity to a solid form which can be removed from the plant under controlled conditions. Occasionally some water will have to be discharged due to inventory problems; this water is cleaned even further prior to discharge with the blowdown from the cooling towers in order to keep offsite exposure as low as practicable. The radioactive material releases due to liquid discharge are below the established limits of 10CFR20 and the proposed limits of 10CFR50 Appendix I.

Solid radioactive wastes consist of filter media, spent resins, evaporator bottoms, sludges, cleaning materials and other miscellaneous solids including spent reactor components. All solid wastes are packaged. Compressible wastes are compacted into 55 gallon drums. Wet solid wastes are solidified and packaged in 55 gallon drums or other containers meeting the requirements of Title 49 of the Code of Federal Regulations. Solid wastes are shipped off site for disposal in accord with Department of Transportation regulations. Containers of high level waste activity may be stored on site to allow some decay prior to shipment off site.

In summary, the station nuclear system is designed so that the environmental radiation dose due to radio-active material released during normal operation will be as low as practicable as proposed in 10CFR50 Appendix I and less than 1% of 10CFR20 limits. Radioactive releases during accident conditions will be limited to those permitted by 10CFR100.

Turbine System

The turbine system uses the Rankine steam cycle with a closed regenerative feedwater heating cycle. Steam leaves the reactor vessel at 1020 psia. Steam enters the turbine at 970 psia with a .38% moisture content. The turbine will be a tandem compound turbine generator having a six-flow exhaust end. Steam is exhausted into a condenser designed for 2.5 in. Hg and cooled with circulating water from mechanical-draft cooling towers. Six stages of regenerative feedwater heating are provided including four from the low-pressure turbines and two from the high-pressure turbine. The final design feedwater temperature at normal full load is 420°F.



Direct Cycle Reactor and Turbine System

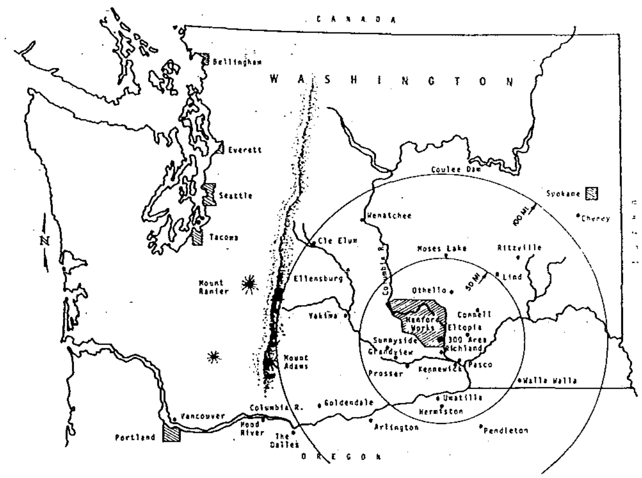
The power cycle includes a reheater at the high-pressure turbine exhaust. Reheating is accomplished in two stages by using steam from the reactor and from one extraction stage of the high-pressure turbine. Two reheater moisture separator assemblies are used.

The turbine building is arranged with the longitudinal axis of the turbine-generator oriented in an approximate east-west direction. The reactor and reactor control buildings are immediately south of the turbine building.

WAC 463-12-010 - GENERAL

(1) Furnish (a) a legal land description of the site.

The Atomic Energy Commission Hanford Reservation comprises all or part of Township 15 North, Ranges 25, 26, 27 and 28 East; Townships 11, 12, 13 and 14 North, Ranges 24, 25, 26, 27 and 28 East; and Township 10 North, Ranges 26, 27 and 28 East, Willamette Meridian. The Wahluke Slope portion of the Reservation located in Grant County includes approximately 134 square miles (86,050 acres). The Benton County portion of the Reservation includes 425 square miles (271,930 acres). The total Reservation includes approximately 559 square miles (357,980 acres). The Hanford Reservation shown by the inset above is illustrated by the boundary map shown in Figure 010-1, and is also illustrated by the folded map contained inside the pocket of the back cover of this binder.



Location of Hanford Reservation

The Atomic Energy Commission, Richland Operations Office, November 25, 1970 letter, Exhibit 1, addressed to the Managing Director of the Supply System, advises that the Atomic Energy Commission has the authority to sell or lease land on the Reservation. This letter further states as follows:

> "This authority is contained in Section 120 of the Atomic Energy Community Act of 1955, as amended, and Section 161G of the Atomic Energy Act of 1954, as amended. There is also general federal disposal authority available under the Federal Property and Administrative Services Act of

1949, as amended."

"The Commission has no objection to the WPPSS employees and consultants entering upon land of the Hanford Works for the purpose of making surveys and investigations of specific plant sites. Access to the plant site can be handled in accordance with WPPSS existing badging procedures. A permit can be granted to WPPSS to cover any on site work required in connection with such surveys and investigations."

The legal description of the Project site is as follows:

All of Sections 29, 30, 31 and 32, and the west half of Section 33, Township 12 North, Range 28 East, Willamette Meridian; and, all of Sections 4, 5, 6, 8, 9, 10, 15 and 16, and the northeasterly half of Sections 7 and 17, and the portion of Sections 11 and 14 West of the Columbia River, Township 11 North, Range 28 East, Willamette Meridian; and the east half of Sections 25 and 36, Township 12 North, Range 27 East, Willamette Meridian; and, that portion of the east half of Section 1 lying northeasterly of the highway, Township 11 North, Range 27 East, Willamette Meridian, all in Benton County, State of Washington.

A copy of the lease with AEC containing the final legal description, including easements and rights of way, will be submitted not later than July 1, 1971.

WAC 463-12-010(1)(a) - *GENERAL* (Supp. filing 7/1/71)

1. The legal land description of the Site was furnished in the original application. A legal description of the area within the described Site to be leased from the U. S. Atomic Energy Commission consisting of two parcels is further described as follows:

PARCEL "A"

Beginning at the southwest corner of Section 11, Township 11 North, Range 28 East, W.M., said corner having Washington State Coordinates, South Zone, of North 408,335.30 and East 2,307,653.50; thence south 89°36'27" west 5,153.61 feet to the TRUE POINT OF BEGINNING: thence north 5,300.00 feet; thence north 46°01'23" west 7,920.86 feet; thence north 5,400.00 feet; thence north 44°28'28" west 7,707.80 feet; thence south 45°00'00" west 7,778.17 feet; thence south 5,400.00 feet; thence east 5,700.00 feet; thence south 1°03'39" east 10,801.85 feet; thence south 43°55'09" east 7,496.68 feet; thence north 45°31'32" east 7,707.78 feet to the TRUE POINT OF BEGINNING.

PARCEL "B"

Beginning at the southwest corner of Section 11, Township 11 North, Range 28 East, W.M., said corner having Washington State Coordinates, South Zone, of north 408,335.30 and east 2,307,653.50; thence north 2,760.00 feet; thence east 3,596.5 feet to the line of navigation of the west bank of the Columbia River; thence southerly along said line of navigation to a point that bears east from the point of beginning; thence west 2,746.5 feet more or less to the POINT OF BEGINNING.

2. A map of description is enclosed as Figure 010-8 showing location of Project boundaries within the proposed Site.

3. The proposed location of facilities including plant location, railroad, roads, power lines, river water pumphouse and pond perimeter are shown on Figure 010-2.

The proposed lease will contain a grant of reasonable rights of way to Supply System for roads, railroads, communication and power lines over other AEC land as required by the Project. The river water lines from the pumphouse to the pond will be provided for in the lease and will run in a direct line west from the pumphouse to the pond. Power line rights of way will be provided for in a separate grant from AEC although the lease will recite that such rights of way will be granted.

4. Negotiations have not been completed on the terms and conditions of the land lease with AEC. The final draft of the lease will be filed by July 31, 1971.

WAC 463-12-010(1)(a) - *GENERAL* (Supp. filing 10/12/71)

Indenture of Lease

There has been filed herewith, as Exhibit 5, a copy of the final draft of the proposed lease between the Applicant and AEC. The lease contains a description of the land conveyed to the Applicant by the Atomic Energy Commission under the terms of the lease, which is different than that set forth in the description of "Parcel A and Parcel B" on page 3 of the supplemental filing of 7/1/71. The description contained in the lease covers an area of approximately 1089 acres. Because of the nature of the ownership of the land, the lease describes two different lease terms; one for a term of 50 years and the other, for the balance of the leased premises, for 30 years. The lease further describes the general "right-of-way" granted to the Supply System by AEC and reserved to AEC for its use. Annual payments for the leased premises are described in paragraph 9 thereof.

The proposed lease must be submitted to the Atomic Energy Commission for review and then to the Joint Committee on Atomic Energy where it must remain for a period of 45 days. If no objections to the provisions of the lease are raised during the 45-day period, the lease is deemed to be approved by the Joint Committee on Atomic Energy and thereafter it may be executed by the appropriate official for AEC.

WAC 463-12-010 - GENERAL

(1) Furnish (b) Land Use Plans, and (c) the latest zoning status.

The zoning status and land uses within a 25 mile radius of the Site as illustrated by Figure 010-3 includes residential and suburban, corporate city, agricultural, industrial and commercial, scenic or recreational, unclassified, and general use land areas. The region within 25 miles of the Site includes areas of Adams, Benton, Franklin, Grant, Walla Walla and Yakima Counties.

The Project is located on the Hanford Reservation within Benton County. The land area of the Hanford Reservation within Benton County is zoned as "Unclassified District" by the Benton County planning Commission and there are no other county or municipal land use restrictions on that portion of the Reservation located within Benton County that conflict with the land use as proposed herein.

Although the Hanford Reservation is a federal reservation, county and state laws do apply to the project area.

A copy of a January 5, 1971 letter from the Benton County Office of the County Engineer is attached as Exhibit 3 and states as follows:

"The area in Township 11 North, Range 28 East proposed by the Supply System as the site for Hanford No. 2 is located in an area zoned as 'Unclassified' and the use of that area for the construction and operation of a nuclear generating project is consistent with zoning ordinances prepared by the Benton County Planning Commission."

The "Unclassified District (U)" is defined in Section XI-A, Page 17 and 18 of the Zoning Ordinance of Benton County (Exhibit 2) dated 1969, in paragraph 1, which states in part, "in the

Unclassified District, all uses of property not otherwise permitted by the laws of Benton County or the State of Washington are permitted except the following enumerated uses, trades or industries may be allowed only by special permit issued by the County Planning Commission....."

The "Unclassified District" classification under the Zoning Code specifically permits any use which is not specifically precluded by the Zoning Code. The Benton County Zoning Code does not preclude but plainly contemplates the operation of all types of nuclear oriented industrial activities in this area.

Adams County

The zoning status and land uses within Adams County within a 25 mile radius of the Site include agricultural, residential and suburban, industrial and commercial, and the corporate city of Othello.

Franklin County

The zoning and land uses of Franklin County within a 25 mile radius of the Site is predominately agricultural and also includes residential and suburban, industrial and commercial, scenic or recreational, unclassified and the corporate cities of Pasco, Mesa and Connell.

Section 010(1d), which follows, includes a survey of the land uses and agricultural products of Franklin County.

Grant County

The land area located in Grant County within 25 miles of the Project area include residential, agricultural, industrial and commercial, scenic or recreational, wildlife refuge, and unclassified.

Walla Walla County

Only a small portion of Walla Walla County is included within a 25 mile radius of the Project area. Zoning and land uses in this area include residential and suburban, agricultural, industrial and commercial, recreational or public reserve and the community of Burbank and Burbank Heights.

Yakima County

All of the area within the boundaries of Yakima County, and within 25 miles of the Project area is designated as being within the "General Use District". No incorporated cities or towns in Yakima County lie within 25 miles of the Project area.

The Supply System has on file the zoning status of all communities within 25 miles of the Project area including the incorporated communities of Basin City, Benton City, Connell, Kennewick, Mesa, Othello, Prosser, Richland, and West Richland.

The Atomic Energy Commission has classified areas within the Hanford Reservation for certain restricted uses. These uses are discussed in Section 010(1d).

WAC 463-12-010 - GENERAL

(1) Furnish (d) a survey of land occupancy and land uses, including residential and industrial, within a 25 mile radius of the immediate site area.

Land Occupancy on the Reservation

According to the U. S. Atomic Energy Commission, the peak daytime working population on the Reservation based on 1969 estimates is 5,500 people, of which 1,300 employees are located in the six production reactor zones (100 areas); 1,900 people in the fuel processing zones (200 areas; and 2,300 people in the laboratory zones (300 area).[1] The locations of the different "areas" are shown on Figure 010-1.

Arid Lands Ecology Reserve

The red cross-hatched area of Figure 010-4 illustrates the 120 square miles in the southwest corner of the Hanford Reservation set aside for long term ecological studies. This large area is relatively undisturbed land of desert-steppe terrain ranging in elevation from about 350 feet to 3,800 feet. Studies being conducted by Battelle Northwest include rainfall, effects of shade and solar radiation with corresponding variations in soil, plant growth, and wildlife.

With the exception of the Arid Lands Ecology Reserve (ALE) and the Columbia River Islands Reserve, established by the AEC, other areas of ecological study shown on Figure 010-4 are only temporarily restricted for studies such as the investigation of sagebrush and grass regrowth from a lightning originated fire of approximately 19,000 acres which occurred in July 1970. The temporarily restricted areas could be used for Project site purposes if arrangements satisfactory to the AEC are made. [1]

Islands in that portion of the Columbia River adjacent to the Hanford Reservation are excluded from public use by the AEC and restricted for several species of wildlife, and related uses. [1]

With the exception of the Arid Lands Ecology Reserve, the islands in the Columbia River and the atmospheric sampling towers, most of the ecology study programs could be performed at other sites on the Reservation.

The red cross-hatched area to the north of the Columbia River on Figure 010-4 illustrates a 32,000 acre area that will be developed as a wildlife refuge by the U. S. Bureau of Sport, Fisheries, and Wildlife. Public access is not permitted is this area.

The two green cross-hatched areas on Figure 010-4 illustrate areas that are available for recreational use. The smallest is a 4,000 acre area presently used by the State of Washington Department of Game for controlled hunting. It is located on the west side of the Columbia River opposite the original townsite of Hanford. The larger area represents 54,000 acres where hunting will be permitted during daylight hours, and will be limited to shotgun and bow and arrow. Fishing and other recreational activities will be determined by the Game Department at a later date.

Ponds and marshes have developed recently as the result of the installation of irrigation facilities in the Columbia Basin Irrigation Project. [2]

WAC 463-12-010 - GENERAL

(1) Furnish (d) a survey of land occupancy and land uses, including residential and industrial, within a 25 mile radius of the immediate site area.

Land Occupancy on the Reservation

According to the U. S. Atomic Energy Commission, the peak daytime working population on the Reservation based on 1969 estimates is 5,500 people, of which 1,300 employees are located in the six production reactor zones (100 areas); 1,900 people in the fuel processing zones (200 areas; and 2,300 people in the laboratory zones (300 area).(1) The locations of the different "areas" are shown on Figure 010-1.

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The red cross-hatched area of Figure 010-4 illustrates the 120 square miles in the southwest corner of the Hanford Reservation set aside for long term ecological studies. This large area is relatively undisturbed land of desert-steppe terrain ranging in elevation from about 350 feet to 3,800 feet. Studies being conducted by Battelle Northwest include rainfall, effects of shade and solar radiation with corresponding variations in soil, plant growth, and wildlife.

With the exception of the Arid Lands Ecology Reserve (ALE) and the Columbia River Islands Reserve, established by the AEC, other areas of ecological study shown on Figure 010-4 are only temporarily restricted for studies such as the investigation of sagebrush and grass regrowth from a lightning originated fire of approximately 19,000 acres which occurred in July 1970. The temporarily restricted areas could be used for Project site purposes if arrangements satisfactory to the AEC are made.[1]

Islands in that portion of the Columbia River adjacent to the Hanford Reservation are excluded from public use by the AEC and restricted for several species of wildlife, and related uses.[1]

With the exception of the Arid Lands Ecology Reserve, the islands in the Columbia River and the atmospheric sampling towers, most of the ecology study programs could be performed at other sites on the Reservation.

The solid red area of Figure 010-4 illustrates a 4,000 acre area presently used by the State of Washington Department of Game for controlled hunting on the east side of the Columbia River opposite the original townsite of Hanford.

The green area of Figure 010-4 contains approximately 37,000 acres north of the Controlled Hunting Area and east of the Primary Control Zone. This green area is restricted to controlled access and is managed by the AEC.[1]

The cross-hatched green area will remain for the existing operating and standby AEC reactors and is referred to by the Advisory Committee for Reactor Safeguards (ACRS) as the "Primary Control Zone." Present indications are the AEC will retain title to the 49,000 acres in this green cross-hatched area and restrict activities except for programs compatible with existing operating and standby reactors, and for the possible need for exclusion area for any new AEC related activity.

Pond and marshes have developed recently as the result of the installation of irrigation facilities in the Columbia Basin Irrigation Project.[2]

Land Use Adjacent to the Reservation

The land use adjacent to the Hanford Reservation is primarily agricultural with the nearest farms located along the east bank of the Columbia River, in Franklin County.

Figure 010-5 illustrates the population distribution for both the 25 mile and 50 mile circles from the approximate center of the Reservation. The population distribution adjacent to the Site is based upon the U. S. Census Bureau estimates for 1970. The total region within both the 25 and 50 mile radii is sparsely populated. The Tri-Cities (Kennewick, Pasco and Richland), southeast of the Site, comprise approximately 35% of the total population of the area, while west of the Site the City of Yakima accounts for approximately 25%. The remaining population, approximately 40%, is scattered along the Yakima River between the Tri-Cities and Yakima. There is no significant seasonal variation of the population in the region except for increases of farm labor during seasons of agricultural harvest.

The types of farms and farm animal populations to be found immediately east of the Project in Franklin County is best indicated by the information provided from the South District of the Columbia Basin Irrigation Project, which includes a large portion of Franklin County adjacent to the Hanford Reservation. The livestock and crop data for Franklin County are shown by the following two tables:

COLUMBIA BASIN IRRIGATION PROJECT
SOUTH DISTRICT
Livestock Numbers for Fall 1969

Dairy Cows	887	Ewes	4,316
Beef Cows	4,799	Lambs	410
Calves	5,233	Other Sheep	629
Other Cattle	13,019	Hens & Pullets	2,647
Sows	42	Other Chickens	107
Market Hogs	866	Turkeys	9
Pigs	404	Other Poultry	38
Other Swine	90	Horses	509

SOUTH DISTRICT
Crop Production - 1969

CROP	ACREAGE	CROP	ACREAGE
Wheat	14,891	Asparagus	1,126
Barley	668	Beans-processing	1,485
Corn	5,297	Carrots	24
Oats	118	Corn-sweet	3,056
Grain Sorghum	80	Cantaloupe	20
Other Cereals	14	Cucumbers	51
Total	21,068	Watermelon	124
		Onions	51
Alfalfa Hay	60,693	Peas-Processing	242
Other Hay	565	Potatoes-Early	6,065
Irrigated Pasture	4,928	Potatoes-Late	8,059
Silage	1,492	Total	20,303
Total	67,678		
		Apples	168
Alfalfa Seed	1,355	Apricots	3
Clover	782	Berries	1
Beans	49	Cherries	33
Pea	3,879	Grapes	5
Total	6,065	Pears	74
		Prunes-Plums	7
Beans (dry)	1,791	Total	386
Peppermint	366		
Spearmint	881		
Sugar Beets	11,467		
Total	14,505		

(2) Indicate the source and approximate amount of water required during construction and operation of the plant.

Source

The Columbia River will be the source of water for the Project including requirements for potable, plant process water and cooling water. The Supply System will use a cooling pond for the Project and only the required makeup cooling water will be taken from the Columbia River.

Approximate Amount

The approximate amount of water required during construction will be less than 10 cfs, with an average utilization of about 10% of capacity.

For the offstream cooling pond, the Project makeup cooling water from the Columbia River will be between 50 and 100 cfs depending upon percolation losses to the ground. Any percolation losses from a cooling pond would find its way to the ground water table and ultimately be returned to the river and this portion of the water would not be consumptive use.

During operation, approximately 0.5 cfs will be required for station services, and the fire protection system will require the availability of between 15 and 20 cfs.

Additional detail concerning availability and quality of water is contained in Section 025 (WATER) of this application.

The source of water for the construction phase of the Project will be a well (or wells) located at or adjacent to the Site. The groundwater table at the Hanford No. 2 Site as measured by the Supply System in April 1971 is approximately 65 feet below the surface of the ground.[4] As previously indicated the amount of water required during construction will be less than 5,000 gpm with the average utilization of about 10% of that amount.

The source of makeup water for Hanford No. 2 including the cooling tower system will be the Columbia River. Makeup water will be withdrawn from the Columbia River at a maximum rate of 25,000 gpm, which is less than 0.05% of the average annual flow of 115,000 cfs.

The project pumphouse on the Columbia River will contain three pumps, each of which will have a capacity of 12,500 gpm with an 80-foot head. Normally only two of these pumps are to be operated at any one time, with a third pump being a spare and available for intermittent backflushing of the intake system.

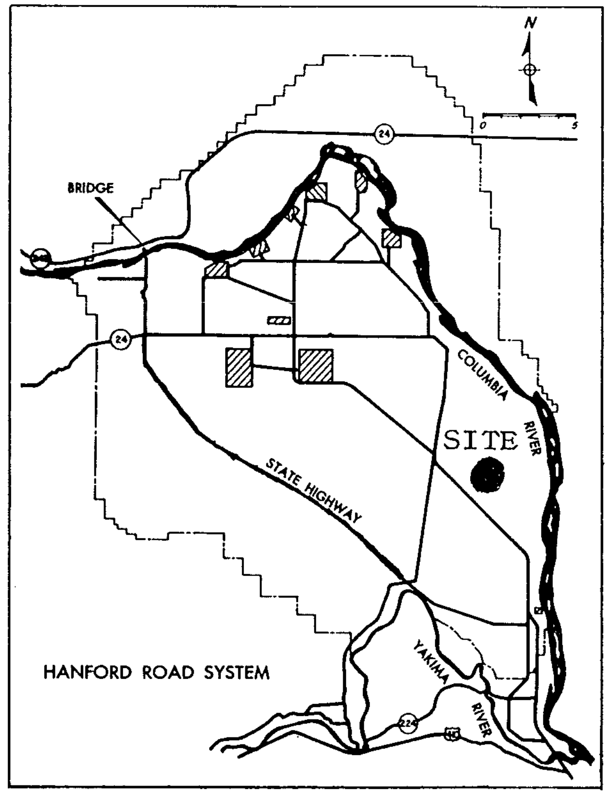
Maximum evaporative losses of 15,000 gpm (34 cfs) from the cooling tower system will take place in the summer. During the winter some low ambient temperature and consequent heat loss by convection will reduce the amount of evaporation required to maintain condenser cooling water inlet temperatures. Since the minimum licensed release of water from Priest Rapids Dam is 36,000 cfs, the consumptive diversion of water from the Columbia River is only about 0.1% of the minimum flow or 0.03% of the average annual flow of 115,000 cfs.

In the event that there is no other consumptive use of the condenser effluent it will be necessary to reduce the amount of river water nonvolatile contents that are concentrated by evaporation of river water in the cooling towers by returning approximately 20% of the total project makeup water to the river. This cooling water diversion (blowdown) from the cooling towers will be discharged at an expected rate varying between 6,500 gpm (14.5 cfs) and 2,000 gpm (4.5 cfs) with concentrations of river salts ranging from three to ten times raw river water content. Since this portion of the total cooling tower makeup water requirement is returned to the river, it reduces the consumptive use of water from the Columbia River.

The Project river pumphouse and cooling tower characteristics are described in Section 025(2)(b). The outfall facilities are described in Section 025(2)(c) and a summary of the Battelle Hydrological Report is included in Section 025(1)(c).

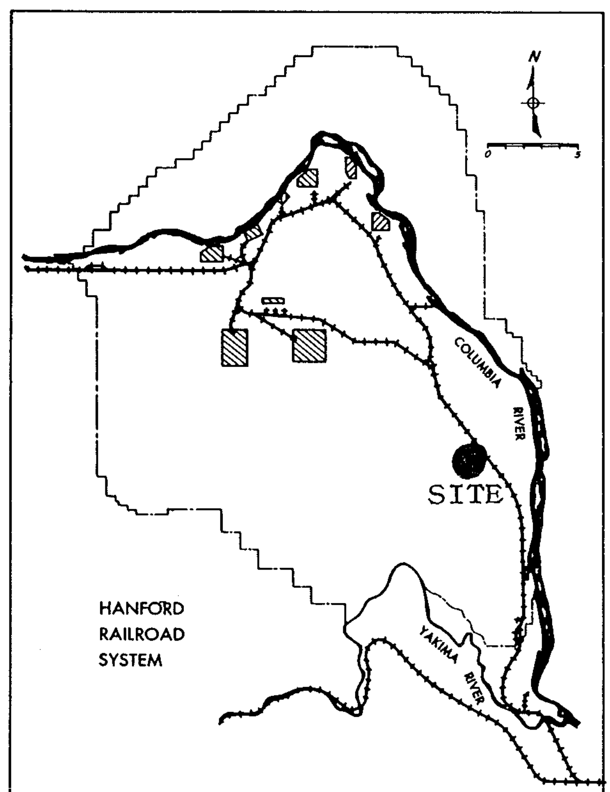
WAC 463-12-010 - GENERAL

(3) Describe the available roads and railroads and indicate what additional access is required for ingress and egress of personnel and materials during plant construction and operation of the plant.



Existing Roads

The AEC owned road system connects the areas of the reservation with approximately 270 miles of paved two-lane and four-lane primary roads, 175 miles of secondary gravel roads, and 225 miles of gravel and unimproved roads. State and national highway standards prevail for equipping and maintaining the road system. The layout of the Hanford road system is as shown by the inset entitled "Hanford Road System."



Existing Railroads

The AEC owned railroad system, as illustrated, has a capability of moving approximately 12,000 cars per year over 150 miles of Reservation track. The system includes 5 main lines, 195 subsidiary lines, and 2 classification yards. A typical inventory of rolling stock in 1969 included 5 diesel electric locomotives, 13 custom built cask cars, 55 gondola hoppers, tank and flat cars, and 19 inspection and maintenance vehicles.

Equipment maintenance is accomplished in a 9,000 square foot shop facility containing necessary trackage and a 45 ton crane.

Barging Facilities

Barges of 2,000 to 3,000 tons capacity can be accommodated over almost the entire Columbia River course within the Hanford Reservation. In the event that manufacturers of large items of equipment elect to use barge transportation for delivery to the Project site, unloading facilities will be provided. Project equipment that may require barge transportation include the pressure vessel of a light water reactor and the generator stator. Other heavy items, such as the rotor sections which are subject to railroad transportation limitations, and other bulky equipment, may also require the use of barge delivery.

Additional Access

The Supply System will construct and maintain additional access roads and railroads connecting the Project to the existing AEC highway and AEC railroad systems necessary to construct and operate the Project. Delivery of railroad shipments will be made to the Reservation by Burlington Northern and delivered to the Project by AEC owned railroad equipment.

If barge transport is used, the Supply System will obtain necessary permits and make the required arrangements for barge access to the appropriate unloading point near the Project site.

A folded map of the Hanford Reservation utilities is contained in the pocket on the inside back cover of this binder.

Permanent Hanford No. 2 structures to be located on the west bank of the Columbia River will be located in Section 2, Range 28 East, Township 11 North. The structures, waterlines, access roads and other supporting facilities will be sited so as not to interfere with archaeological site 45BN169, located one-half mile to the south in Section 11, nor with the archaeological sites in the "shifting dunes locality" which is more than one mile north of the Hanford No. 2 pumphouse site.

A temporary barge slip may be dredged on the shoreline to receive heavy equipment items such as the reactor vessel. Siting of any temporary barge slip that may be required will be planned so as to avoid all archaeological sites including those listed in Section 010(6).

The Supply System will comply, and will require all construction contractors to comply with all federal, state and local codes and regulations applicable to the construction of the barge slip. To assure minimal environmental impact due to the use of a barge slip, the Supply System will develop plans jointly with federal, state and local agencies having departmental interest or regulatory authority over plans, designs, schedules and removal of the barge slip facilities. The Supply System will comply, and will require its contractors to comply, with all conditions and limitations imposed by permits and approvals required for barge access to the unloading point near the project site.

Hanford No. 2 Access Road Construction Standards

The primary access roads constructed by the Supply System serving the Hanford No. 2 central plant facility will be constructed so as to meet or exceed applicable Washington State and AEC design standards. The Washington State County Arterial Design Standards adopted May 17, 1968, illustrated by Table 010(3)-1 contains design standards for "Average Daily Traffic" and "Design Hourly Volume."

Access Needs

The approximate location of the primary access road serving the central plant facilities and the short railroad spur from the existing railroad are illustrated by the updated map of Hanford Reservation Utilities included in this supplemental filing for insertion in pocket on the inside back cover of this binder. The in-plant service roads will be designed for appropriate load requirements and for use as permanent access needs for operation, inspection and maintenance.

Supplemental Information on Railroad System

The description of the Hanford Reservation railroad system contained on pages 1 and 2 of this section pertain to the system existing in 1969. As of August 1971 the description remains accurate except that the rail system now comprises 138 miles of track on the Reservation due to the removal of spur trackage to the F and H reactor areas and the addition of four miles of spur trackage to the FFTF site. The Hanford Reservation railroad system is served by Burlington Northern and Union Pacific at the classification yards in North Richland and by the Milwaukee Road at Riverland, Washington, located at the northwestern boundary of the Hanford Reservation.

Motor Carriers

Recently revised motor carrier tariffs now provide for delivery direct to the FFTF and Hanford No. 2 site under the tariff charge to Richland, Washington. This revised tariff eliminates the need for trans-shipment of motor carrier freight at Richland.

WASHINGTON STATE COUNTY ARTERIAL DESIGN STANDARDS

PROPOSED: MAY 15, 1968 — **ADOPTED: MAY 17, 1968**

ADT	Current	Under 250		250-400		400-750					
DHV	15 Yrs. Hence					100-200		200-400		400+	
		Max. D°	Min. R'	Max. D°	Min. R'	Max. D°	Min. R'	Max. D°	Min. R'	Max. D°	Min. R'
CURVATURE	Flat	8.5	694	8.5	694	7.5	758	7.5	758	7.0	833
	Rolling	13.5	427	13.5	427	12.5	464	12.5	464	11.5	508
	Mountainous	25.0	231	25.0	231	23.0	250	23.0	250	21.0	273
MIN. STOPPING SIGHT DISTANCE (Ft.)	Flat	350		350		350		350		350	
	Rolling	275		275		275		350		350	
	Mountainous	200		200		200		350		350	
MAXIMUM GRADE [1] (%)	Flat	6		6		6		4		4	
	Rolling	8		8		7		5		5	
	Mountainous	11		11		9		7		7	
NEW BRIDGES [2]	Width (Curb to Curb)(Ft.)	26		26		28		40		40	
	Design Load(AASHO)	H-20		H-20		H-20		H-20		H-20	
	Vertical Clearance (Ft.)	14.5		14.5		14.5		14.5		14.5	
MIN. PAVEMENT WIDTH (Ft.)		20		20		22		24		24	
ROADWAY WIDTH [3] (Ft.)		28		28		34		40		40	
NUMBER OF LANES		2		2		2		2		2	
RIGHT OF WAY WIDTH (Ft.)		60		60		60		Adequate		Adequate	

1. May be steeper for short distances.
2. All bridge curbs to meet State standards.
   Sidewalks to be determined on an individual basis.
3. For guardrail installation, width of shoulder to be additional two feet.

Geometric design standards for over 600 DHV shall be determined from the results of an engineering study based on AASHO or other acceptable standards.

(4) Submit an approximate routing as well as conceptual design and type of all proposed associated transmission lines to be constructed between the plant site and their connecting points with existing Northwest grid and proposed plans for treatment of the natural features of the landscape, such as the existing vegetation and terrain, and newly planted vegetation.

The transmission line from the Project will make connection to the Bonneville Power Administration's 500 kv switchyard in the 100-N area of the Hanford Reservation utilizing a corridor that will be defined by July 1, 1971. Transmission lines for plant startup and emergency shutdown power may require two 230 kv or 115 kv lines, or combination thereof, interconnecting with existing local power facilities and may include provision for back feed from the 500 kv transmission line. Corridors for these lines will also be defined by July 1, 1971.

Treatment of the natural features of the landscape, such as existing vegetation and terrain will be minimal since the highest order of natural vegetation between terminals is sagebrush interspersed with desert grasses. The line will be constructed with minimal disturbance to the natural vegetation to avoid exposing soils to wind erosion.

The right-of-way will be designed to avoid steep slopes and other areas where unusual impact and/or special treatment is required.

No main highways, shelter belts or scenic areas will be affected. The line construction will be coordinated with AEC land use planning and with other existing or proposed right-of-ways.

Figure 010-6, BPA Drawing No. TD-2224-D, entitled "500 KV Single Circuit Transmission Tower Delta Configuration 3-ACSR (Aluminum Cable Steel Reinforced) Bunting Per Phase" illustrates the proposed conceptual design of the single circuit transmission line between the Site and its connecting point with the existing Northwest grid.

The criteria outlined above complies with the February 1970 "Environmental Criteria for Electric Transmission Systems"[(3)] published by the U. S. Department of Interior and Department of Agriculture insofar as it is applicable to vegetation and terrain at the Site.

WAC 463-12-010(4) - *GENERAL* (Supp. filing 7/1/71)

Figure 010-1 (Revised July 1, 1971) and the folded map of the Hanford Reservation Utilities (revised July 26, 1971 and contained in the inside back of this binder) illustrate the corridors of the three proposed transmission lines to be constructed between the Project site and their interconnecting points with the Bonneville Power Administration transmission grid.

The three transmission lines are described as follows:

500 KV Single Circuit -- This transmission line will be the primary transmission line making connection to the Bonneville Power Administration's 500 kv switchyard in the 100 N area of the Hanford Reservation. This line will extend 18.3 miles in length utilizing steel towers of the "banjo" design as illustrated by the BPA drawing, Figure 010-6, supporting "triple bunting" conductors per phase on a 135 foot right-of-way.

230 KV Single Circuit -- The Project's "station service" transmission line will consist of the conventional steel tower design utilizing "flat" configuration and extending from the Project switchyard to the existing Bonneville Power Administration 230 kv grid connection located in Section 21, Township 13 North, Range 27 East, East Willamette Meridian. This 11.5 mile interconnection will utilize a 125 foot right-of-way.

115 KV Single Circuit -- The Project's "backup" power supply interconnection between Hanford No. 2 and the Bonneville Power Administration's Benton Switching Station located in Section 11, Township 11 North, Range 28 East, will utilize a conventional wood pole "H-frame" structure with "flat" conductor configuration

extending 6.1 miles around the southern end of the Project cooling pond and utilizing a 90 foot right-of-way.

The construction schedule for the three transmission lines described above will be as follows:

500 KV	January 1, 1975 through January 1, 1977
230 KV	June 1, 1975 through June 1, 1976
115 KV	January 1, 1974 through January 1, 1975

A portion of the 115 kv "backup" transmission line is scheduled to be constructed by Bonneville Power Administration in 1971 or 1972 to furnish station service for the Fast Flux Test Facility located two and one-half miles southwest of the Hanford No. 2 Site. The Supply System, Bonneville Power Administration, AEC, and Westinghouse Advance Reactor Development Company will coordinate the planning of this 115 kv right-of-way from the Benton County Switching Station in order to provide joint use of this facility.

WAC 463-12-010(4) - GENERAL (Supp. Filing 9/27/71)

Temporary Construction Power

Bonneville Power Administration is presently planning the right of way for temporary construction power to be delivered in September 1972. This temporary power supply will be obtained by advancing the construction of the permanent 115 KV "backup" power line to 1972 thus avoiding unnecessary environmental effects of duplication. Location of this 115 KV transmission line is illustrated on the fold out map located in the inside back cover of this binder and is also illustrated by Figure 010-10 "Site Overall Plan".

Studies are presently underway to determine whether the temporary and permanent power supply to the river water pumphouse will be supplied by a short 115 KV tap to Benton County substation; a temporary overhead construction power line; or an underground circuit connecting with the generating plant.

Vegetative Restoration - Transmission Right of Way

Restoration of disturbed vegetation on a transmission line right of way can be assisted by reseeding the affected areas in late fall and early winter to establish vegetative cover that will encourage the return of the indigenous growth.

The Supply System's own experience during the construction of the 24 mile 500 KV transmission line from Hanford No. 1 to the BPA-Vantage switchyard confirmed that the indigenous cheat grass quickly restores itself in all disturbed areas and holds soil from wind and water erosion until other more permanent vegetation recovers.

Further discussion of criteria for controlling wind and water erosion is contained in Section 020(2) (Supp. filing 9/27/71).

(5) Submit plans relating to satisfaction of existing statutory criteria, requirements, standards and regulations of those state agencies which, prior to certification, have any legal authority over conditions or activities related to the site.

The Supply System will comply with all existing State statutory and administrative regulations which are applicable to the proposed Site and the activities which will be conducted at the Site during construction and operation of the Project.

The following sections describe those State agencies which have promulgated regulations or have statutory jurisdiction over the proposed Site or activities expected to occur at or near the Site during construction or operation of the Project and outlines the plans of the Supply System to satisfy such statutory criteria, requirements, standards and regulations of State agencies.

(A) Air Pollution Control Board -- (Title 18 WAC)

The State Air Pollution Control Board has adopted administrative standards applicable on a statewide basis which apply to the proposed Site. The regulations which are potentially applicable include:

Chapter 18.28 WAC - relates to information reporting by thermal power plants

Chapter 18.32 WAC - carbon monoxide standards

Chapter 18.40 WAC - suspended particulate standards

Chapter 18.44 WAC - particle fallout standards

Chapter 18.48 WAC - fluoride standards

Chapter 18.56 WAC - sulfur oxide standards

The Supply System will render reports as required by WAC 18.28 and will insure that all other standards of the Air Pollution Control Board are satisfied.

(B) Department of Civil Defense -- (Title 118 WAC)

Section 2A of the Washington State Department of Civil Defense Operation Plan for Natural Disaster deals with nuclear accidents and establishes a radiation hazard control plan. The plan is concerned primarily with accidents in the course of escorted and unescorted shipment of radioactive materials and/or unexploded nuclear weapons involved in aircraft accidents. The Supply System will comply with the obligations set forth in the Civil Defense Plan.

The Washington State Department of Civil Defense bases its plans upon provisions of the Federal Civil Defense Guide, Chapter 5, Appendix 10, dealing with "Peacetime Radiological Incidents". It requires local Civil Defense Directors to (1) inventory major users of radioactive materials in given localities, (2) establish an inventory of radiological monitoring equipment, (3) maintain a listing of names, addresses and telephone numbers of health physicists and other persons who have radiation safety training, (4) maintain lists of other agencies, services, personnel useful or pertinent in emergencies, and (5) development of local plans including detailed procedures for reporting to the State any radiological incidents affecting the general public including education plans for the general public and radiological incident training of appropriate personnel in order to insure that:

(1) emergency actions can be taken to minimize personal injury, loss of life, property damage and radiological hazards, and

(2) procedures can be implemented to inform the public and assist in restoring normalcy as soon as possible after an incident.

The Supply System will cooperate fully with the State Department of Civil Defense in order to establish such a plan. The Federal guide also establishes an interagency radiological assistance plan and directs that the Atomic Energy Commission is the agency responsible for administration, implementation and application and coordination of the provisions of the interagency radiological assistance plan. The Supply System expects that the AEC license will require the Supply System to participate in these programs.

(C) Board Against Discrimination -- (Title 162 WAC)

The Supply System will require its independent contractors, and will itself comply with the regulations of the State Board Against Discrimination and State Law under which said regulations are promulgated as well as Federal statutes against discrimination. All Contract Specifications for work at the Project will comply with all applicable State and Federal regulations accordingly.

(D) Employment Security Department -- (Title 192 WAC)

Title 192 of the Washington Administrative Code establishes regulations governing reporting of persons or entities from whom personal services are obtained (WAC 192-12-030). Maintenance of Records (WAC 192-12-050), Employer elections to cover individuals performing personal services in more than one state (WAC 192-12-090) and posting of notices by employers (WAC 192-12-100). Contract clauses in the Supply System's plans and specifications will require all contractors to adhere to the requirements of Title 192 of the Washington Administrative Code. Additionally, the Supply System will be making payment to its contractors pursuant to the retained percentage law which protects the Department against losses from non-payments of such contributions by an employer to the Employment Security Department. Following Project completion, the Supply System will comply with the same regulations and statutes with respect to its employees as it does now.

(E) Board and Department of Health -- (Title 248 WAC)

The following chapters of the Department of Health administrative regulations would govern construction contracts and operations of the Supply System's plant after construction.

Chapter 248.50	WAC	General Sanitation
Chapter 248.60A	WAC	Labor Camps
Chapter 248.62	WAC	Sanitation of Places of Work
Chapter 248.84	WAC	Food Service Sanitation
Chapter 248.94	WAC	Basic Plumbing Principles
Chapter 248.104	WAC	Personnel Practices
Chapter 248.108	WAC	Wiping Rags
Chapter 248.108	WAC	Registration of Reportable Radiation Sources
Chapter 248.120	WAC	Regulations for Radiation Control

The provisions of the construction contract will require the Supply System's contractors to be informed of and to at all times observe and comply with all such valid and legal binding ordinances and laws and regulations.

(F) Department of Labor & Industries -- (Title 296 WAC)

Contracts for construction will require compliance by all contractors with all applicable safety standards including those tabulated below:

Chapter 296.81	WAC	Elevators
Chapter 296.70	WAC	Tunnels
Chapter 296.62	WAC	Occupational Health Standards
Chapter 296.47	WAC	Electric Wiring & Apparatus
Chapter 296.45	WAC	Electric Workers
Chapter 296.44	WAC	Electrical Construction Standards
Chapter 296.40	WAC	Construction Standards
Chapter 296.37	WAC	Safety Standards - Installing Electric Wires & Equipment
Chapter 296.25	WAC	General Safety Standards

(G) Department of Ecology -- (Title 372 WAC)

Subject to final Site investigations and design determination, it is anticipated that a continuous or intermittent discharge of water will be required from the Project's cooling pond to control build-up of solids. This discharge may be through percolation or by discharge control facilities.

The Supply System will review its plans pertaining to disposal of said discharges in a timely manner with the Council. Thermal and effluent discharge will at all times be consistent with State Water Quality Standards set forth in Chapter 372-12 WAC. Facilities for monitoring of receptor media, inspection of control facilities and monitoring of any waste discharges will be installed and maintained by the Supply System, pursuant to WAC 372-12-130, 140 et. seq.

The State of Washington Department of Ecology Interim Regulation DE 70-2 implements Sec. 21(b) (1) of the Federal Water Quality Improvement Act of 1970, and requires applicants to obtain a "certification" from the State in which a discharge into navigable waters originates, and provide reasonable assurance that the discharge will not violate applicable water control standards.

The Supply System will comply with the Water Quality Improvement Act of 1970 and the Federal Water Pollution Control Act 33 USCA 1171 (b) (1), as well as the Refuse Act of 1899 (33 USCA 407) (applying to an applicant to the AEC and/or to the Department of the Army) and to the extent required by the Council.

(H) Radiation Control Agency -- (Title 402 WAC)

The Supply System's Project and operation thereof are considered to be exempt from the provisions of Title 402 due to preemption by the Atomic Energy Act of 1954 and subsequent amendments. However, the Supply System standards for construction and operation of the Project will be consistent with the existing regulations of Title 402 WAC.

(I) Advisory Committee on Transportation of Dangerous Cargoes -- (Title 470 WAC)

The Supply System's Project and operation thereof are considered to be exempt from the provisions of Title 470 due to preemption by the Atomic Energy Act of 1954, as amended, and AEC regulations and licensing procedures pursuant thereto. However, the standards for construction and operation of the Project will be consistent with the existing regulations of Title 470 WAC.

(J) Division of Water Resources, Department of Ecology -- (Title 508 WAC)

The Supply System's Project will require continuous or intermittent withdrawal of make-up water from the Columbia River to replenish evaporation and percolation losses of the cooling pond, and to supply other needs during construction and subsequent operation of the plant.

If required, provision will be made for metering of water withdrawals during construction and operation of the Project pursuant to Chapter 508-64.

The water which will be withdrawn from the Columbia River will, for the most part, be returned by percolation through ground water and/or discharge, subject to conditions of effluent discharge standards specified by the State of Washington.

Plans and specifications for the cooling pond, including size and configuration, will be submitted to the State of Washington pursuant to RCW 90.03.350.

WAC 463-12-010(5) - GENERAL

As requested by the Council, this supplement provides specific citations to statutes vesting legal authority in various state agencies, which, prior to certification, would have legal authority over conditions or activities related to the Site and/or state agencies which have adopted standards and regulations referred to in the original application. In addition to statutory references, which are not clearly required by the guidelines, the following supplement makes reference to certain additional administrative regulations which may bear upon or relate to the application as well as legislation enacted by the state legislature since the filing of the application.

(A) Air Pollution Control Board -- (Title 18 WAC)

Section 43.21A.300 RCW abolished the state air pollution control board as of July 1, 1970. Section 43.21A.040 RCW created the Department of Ecology, and Section 43.21A.060 transferred to the new department the duties, powers and functions of the Air Pollution Control Board and the air pollution activities of the Department of Health. All rules and regulations of the Air Pollution Control Board were to be continued and acted upon by the Department of Ecology. "The director of the department of ecology is authorized to adopt such rules and regulations as are necessary and appropriate to carry out the provisions of this chapter." 43.21A.080RCW

(B) Department of Civil Defense -- (Title 118 WAC)

The Washington State Department of Civil Defense was created by Section 38.52.030RCW. Section 38.52.050 authorizes the governor to make, amend, or rescind any orders, rules, and regulations necessary to carry out the provisions of Chapter 38.52 RCW and to delegate any administrative authority vested in him under Chapter 38.52.

(C) Board Against Discrimination -- (Title 162 WAC)

The Washington State Board Against Discrimination was created by Section 49.50.60 RCW. Section 49.60.120 authorizes this board to adopt, amend, and rescind suitable rules and regulations to carry out the provisions of Chapter 49.60 RCW, and the policies and practices of the board in connection therewith.

"The right to be free from discrimination because of race, creed, color, or national origin is recognized as and declared to be a civil right. This right shall include, but not be limited to . . . (the) right to obtain and hold employment without discrimination . . ." 49.60.030 RCW. It is an unfair practice for an employer to refuse employment, to discharge, to bar from employment, to discriminate in terms of conditions of employment, or to express any specification or limitation (not based upon a bona fide occupational qualification) for prospective employment on the basis of a person's age, race, creed, color, or national origin. 49.60.180 RCW

(D) Employment Security Department -- (Title 192 WAC)

Section 50.08.010 RCW established the Employment Security Department to be administered by a commissioner. RCW 50.12.040 authorizes the commissioner to promulgate procedural rules and regulations. (See Bertel v. Employment Security Department, 60 Wn. 2d 709, 375 P. 2d 154).

(E) Department of Social and Health Services (Board and Department of Health) -- (Title 248 WAC)

The Department of Social and Health Services was created by RCW 43.20A.030. Simultaneously RCW 43.20A.500 abolished the Department of Health. RCW 43.20A.520 provides that the rules and regulations of the departments and agencies affected by the 1970 amendatory act which created the Department of Social and Health Services are to be continued and acted upon by the Department of Social and Health Services.

The State Board of Health is authorized to adopt rules and regulations controlling public health related to environmental conditions. RCW 43.20.050.

Supplemental Data Relating to Administrative Regulations

a. Chapter 248.108 WAC (referred to in Section 010(5)(G) at page 4 of the application was adopted pursuant to the provisions of Chapter 70.72 RCW.

b. The provisions of Chapter 248-116 WAC, "Registration of Reportable Radiation Sources" (erroneously cited as Chapter 248.108 WAC in Section 010(5)(G) at page 4 of the application) were adopted pursuant to the provisions of RCW 70.98.050. See also discussion of the Radiation Control Board, below at Section 010(5)(H), acknowledging transfer of the Board's functions to the Department of Health and Social Services.

(F) Department of Labor and Industries -- (Title 296 WAC)

The Department of Labor and Industries was created by Section 43.17.010 RCW. The position of Supervisor of Safety, an assistant director of labor and industry, was created by 43.22.040 RCW. The Director of Labor and Industries, through the Division of Safety, is authorized to make and modify standards of safety for those industries covered by industrial insurance. See RCW 49.16.020 - 050.

Supplemental Data Relating to Administrative Regulations

Chapter 296-44 WAC (pertaining to electrical construction standards) is subject to the provisions of Chapter 19.29 RCW. The Director of Labor and Industries is authorized to adopt regulations altering the rules contained in Chapter 19.29 RCW, insofar as such new rules do not decrease the measure of safety provided by the existing rule. See RCW 19.29.40 RCW.

Chapter 296-46 WAC (pertaining to safety standards for installing electric wire and equipment) was issued by the Electrical Inspection Division of the Department of Labor and Industries under the authority of Chapter 19.28 RCW. The Director of Labor and Industries is authorized to adopt reasonable rules and regulations in furtherance of safety to life and property. RCW 19.28.060.

Every enclosed room in which machinery and manual labor are used for gain must have good and sufficient ventilation and be kept in a clean and sanitary state. RCW 49.20.20. One of the express purposes of Chapter 296-62 WAC is to assist in the provision of such a healthful working environment. 296-62-010 WAC

The Director of Labor and Industries is authorized to establish such rules and regulations as he deems primarily necessary for the safety of those employed in tunnels, quarries, etc. RCW 49.24.370. Chapter 296-70 WAC contains safety standards for tunnels, shafts, and subways.

Section 70.87.030 RCW directs the Director of Labor and Industries to administer Chapter 70.87 RCW (pertaining to elevators, lifting devices, and moving walks) through the Supervisor of the Division of Building and Construction Safety Inspection Services. The supervisor is authorized to promulgate and adopt such rules and regulations as may be necessary regarding the construction, operation, etc. of such devices. Chapter 296-81 WAC contains rules pertaining to elevators, lifting devices, etc.

(G) Department of Ecology -- (Title 372 WAC)

The Department of Ecology was established pursuant to the provisions of Chapter 62, Laws of 1970, Second Extraordinary Session, effective July 1, 1970. Chapter 43.21A RCW transfers all the powers, duties and functions of the Department of Water Resources, the Water Pollution Control Commission, the State Air Pollution Control Board and the Water Resources Advisory Board as they existed prior to July 1, 1970, and continues all rules, regulations and pending business of these departments to the Department of Ecology, and further vests the Department of Ecology with all the powers, duties and functions authorized to be performed by the old Water Pollution Control Commission pursuant to Chapter 90.48 RCW, the Department of Water Resources or the director thereof under the terms of Chapter 43.27A RCW, the powers, duties and functions with reference to air pollution previously exercised by the Department of Health or the director thereof, and/or by the State Pollution Control Board or its executive director by terms of Chapter 70.94 RCW, the Washington Clean Air Act or otherwise, and all powers, duties and functions authorized to be performed by the Department of Health or director of health involving the control of pollution problems created by the disposal of solid waste pursuant to the provisions of Chapter 70.95 RCW.

Supplemental Data Concerning Administrative Regulations

The Department of Ecology filed emergency regulations, Order No. DE 71-8 and DE 71-12 since the filing of the application in these proceedings. These emergency regulations pertain to procedures for obtaining certification by the State of Washington that activities proposed to be conducted by Applicant to the United States Corps of Engineers for purposes of Section 13 of the Refuse Control Act of 1899 are consistent with state water quality standards. The Applicant expects that a permit issued by the Thermal Power Plant Site Evaluation Council will constitute "certification" for purposes of the federal Water Quality Act (Public Law 91-224) or, in any case, that the issuance of a permit by the Thermal Power Plant Site Evaluation Council would enable the Department of Ecology to issue "certification" for purposes of the Water Quality Act without further hearings or legal process.

Supplemental Data re 1971 Legislation

The 1971 legislature adopted the "Shorelines Management Act of 1971" (Laws of 1971, First Extraordinary Session, Chapter 286). The Site is considered to occupy and be related to a shoreline of "statewide significance" as defined by the Act. Although applicants to the Thermal Power Plant Site Council under Chapter 80.50 of the Revised Code of Washington are not required to obtain permits otherwise prescribed by the Shorelines Management Act of 1971, the applicant is confident that the operation of the project can be conducted so as to comply with the general policies of the Shorelines Management Act as well as regulations, guidelines and master programs which may be adopted pursuant to the Act.

(H) Radiation Control Agency -- (Title 402 WAC) (See discussion of State Department of Social and Health Services, Paragraph E. above).

The functions of the State Radiation Control Agency were transferred to the Department of Social and Health Services pursuant to Section 16, Laws, Second Extraordinary Session, 1970, Chapter 18: RCW 70.98.050. The Secretary of Social and Health Services was designated as director of programs of the previous "State Radiation Control Agency" and was vested with authority to develop programs ". . . with due regard for compatibility with federal programs for regulation of by-products, source and special nuclear materials: . . . ." (RCW 70.98.050(3)(b)) and was given authority to advise, consult and cooperate with other agencies of the state, the federal government and states and interstate agencies concerned with control of sources of ionizing radiation.

(I) Advisory Committee on Transportation of Dangerous Cargoes -- (Title 470 WAC)

The Advisory Committee on Transportation of Dangerous Cargoes was established by RCW 46.48.190 which also requires that the Washington State Patrol acting by and through the chief of the Washington State Patrol shall have jurisdiction in the transportation of explosives and other dangerous articles. The statute vests the chief of the Washington State Patrol acting with the Advisory Committee on Transportation of Dangerous Cargoes to make rules and regulations sufficient to protect persons and property from unreasonable risk of harm or damage. Although the Applicant reasserts federal preemption, the Applicant expects to cooperate fully with the State Patrol whenever the Applicant or its agents transports any other "dangerous cargo". Applicant will also report its intentions concerning management of nuclear fuel.

(J) Division of Water Resources, Department of Ecology -- (Title 508 WAC) (See discussion Section 010(5)(G) above relating to statutory bases for the Division of Water Resources, Department of Ecology.

In addition to comments in Section 010(5)(G) above, it will be noted that the Supply System, for ecological and environmental considerations and as a condition to the expected lease of the project Site from the Atomic Energy Commission, will be required to install a cooling system that will avoid any effects on existing ground water tables.

(K) Department of Game -- (Title 232 WAC)

The Washington State Department of Game and Game Commission were established under the provisions of Chapter 77.04 RCW. Chapter 77.12 authorizes the Game Commission to promulgate rules and regulations relating to protection of game animals and fish within the public domain of the State of Washington.

RCW 77.16.220 prohibits diversion of water from any lake, river or stream containing game fish unless the channel or pipe connecting with such waters is equipped at or near its entrance with a fish guard or screen capable of preventing passage of game fish. The statute also requires that diversion of water is unlawful unless the plans for fish guards, screens and bypasses are first submitted to the Director of Game for review and approval of the plans before installation. The Applicant expects that the plans for the water intake structure in the facilities described in the application will be reviewed with the Director of Game in the course of proceedings before the Council. (See also Paragraph L., below. (Department of Fisheries))

(L) Department of Fisheries -- (Title 232 WAC)

Chapter 75.04. and 75.08 established the Department of Fisheries and defined the authority and jurisdiction of the Department of Fisheries and the director of the Department of Fisheries as regards protection of food fishes of the State of Washington. The director of the department is authorized by Chapter 75.08 RCW to investigate and classify fish and shellfish of the waters of the State of Washington and in the offshore waters of the State of Washington and to make, adopt, amend and promulgate rules and regulations relating to the protection and conservation of such fisheries resources.

RCW 75.20.040 provides that every ditch, canal, channel or waterpipe used for conducting water from any river or stream for manufacturing or other purposes must be provided with a fish guard so as to prevent the passage of fish into the ditch, canal, channel or waterpipe and that the plan should be approved by the director and that provisions should be made for maintenance of such fish guards and screens as prescribed by the director. As indicated in Section 010(5)(K) above, the Applicant expects to submit its plans for fish protection facilities which will be a part of its water intake structure to the director of fisheries as well as the Department of Game in the course of proceedings before this Council.

RCW 75.20.050 requires that a flow of water sufficient to support game fish and food fish population shall be maintained at all times in the streams of this state and that the Supervisor of Hydraulics may refuse to issue any permit to divert water if, in the opinion of the Director of Fisheries or Game the permit would result in a lowering of the flow of water in any stream below the flow necessary to adequately support food fish and game fish populations in the stream. The Applicant considers that the provisions of this section will not be germane to the proceedings before the Council although in a proper case the Council could consider such facts, if demonstrated, in determining whether or not a permit should be issued.

RCW 75.20.100 requires that the director of the Department of Fisheries and the Department of Game shall be advised as to the approximate date when construction of any hydraulics projects is to commence and written approval of the director of fisheries and Department of Game as to adequacy of the means outlined for protection of fish in connection therewith shall be obtained before commencement of construction. As indicated in the preceding section, the Applicant expects to submit its plans and specifications to the directors of the Department of Fisheries and Game for their review in the course of proceedings before this Council and that any objections, questions or suggestions from the directors of the Departments of Fisheries or Game will be given full consideration by the Applicant and if need be by the Council prior to or at the time of final hearing on the application.

(M) State Fire Marshall -- (Title 212 WAC)

The office of State Fire Marshall is created by Chapter 48.48 of the Revised Code of Washington. Provisions of 48.48 authorize the State Fire Marshall to promulgate safety standards and to inspect premises. RCW 48.48.040 authorizes the Insurance Commissioner acting as State Fire Marshall to promulgate regulations and assist in enforcement of local codes and standards for prevention of fire and/or protection of life and property. The Applicant considers that a plan for fire protection and disaster relief will be required incident to federal licensing will meet standards comparable to any standards referred to in Chapter 48.48 RCW or Title 212 WAC.

(N) Board of Natural Resources -- (Title 332 WAC)

The Surface Mining Act Chapter 64 Laws of Second Extraordinary Session, 1970, Chapter 78.44 RCW charges the Board of Natural Resources with administration of the State Surface Mining Act in cooperation with the Department of Natural Resources.

RCW 78.44.080 requires permits be obtained for surface mining. The Applicant does not consider the provisions of Chapter 78.44 to be applicable to excavations which will be incident to construction of the proposed project.

(6) Submit an inventory of historical and archaeological sites which are existent within the thermal plant boundary area or transmission corridors and state the nature of the methods to be employed to enable their preservation and/or interpretation. (RCW 43.51.750)

No known historical or archaeological sites are located within the proposed Project area or proposed transmission corridor.

Battelle Northwest Laboratories has identified the known historical and archaeological sites in the Hanford Reservation area located along the Columbia River.

Table 010.6-1a summarizes the recommendations made for each site or location according to its description as to the type of the site and the recommendation for any additional work, as well as cost and time for completion.

Table 010.6-1b includes three pages of the historical and archaeological sites listed in Table 010.6-1a containing further description of the nature of the site, legal location and recommendations for each of the listed sites.

A review of Table 010.6-1a confirms that the historical sites and localities identified will not be physically affected by the Project.

In the event a historical site is disturbed or otherwise affected by the Project's construction or operation, the Supply System proposes to retain the services of a competent archaeologist and, in consultation with the Thermal Power Plant Site Evaluation Council, make the necessary arrangements for any preservation and/or interpretation.

SITE NUMBER	OPEN CAMP SITE	HOUSEPITS PRESENT	POSSIBLE HOUSEPITS	ETHNOGRAPHIC CAMP SITE	FISHING STATION	FLAKING FLOOR	HISTORIC SITE	TEST EXCAVATION	SURFACE COLLECTION	NO FURTHER WORK	TIME IN WEEKS REQUIRED FOR SALVAGE	ESTIMATED COST FOR SALVAGE IN 1968
	SITE TYPE							RECOMMENDATION				
45BN101	X	-	-	-	X	-	-	-	X	-	----	----
45BN102	X	-	-	-	X	-	-	X	-	-	0.50	$ 925
45BN103	X	-	-	-	X	-	-	-	X	-	----	----
45BN104	X	-	X	-	X	-	-	X	-	-	0.50	900
45BN105	X	-	X	-	X	-	-	X	-	-	1.00	1,535
45BN106	X	-	-	-	X	-	-	-	-	X	----	----
45BN145	X	X	-	X	X	X	-	-	X	-	----	----
45BN162	X	-	-	-	X	-	-	-	X	-	----	----
45BN163	X	-	X	-	X	-	-	X	-	-	1.00	1,535
45BN164	X	-	-	-	X	X	-	X	-	-	1.00	1,535
45BN165	-	-	-	-	X	-	-	-	-	X	----	----
45BN166	X	-	-	-	X	-	-	X	-	-	0.50	900
45BN167	X	-	X	-	X	X	-	X	-	-	1.00	1,570
45BN168	X	X	-	-	X	-	-	X	-	-	1.00	1,570
45BN169	X	X	-	-	X	-	-	X	-	-	1.00	1,570
45BN170	X	-	-	-	-	X	-	X	-	-	1.00	1,550
45BN171	X	-	-	-	-	-	-	X	-	-	0.50	915
45BN172	X	-	-	-	-	X	-	X	-	-	0.50	950
45BN173	X	-	-	-	-	-	-	X	-	-	1.00	1,600
45BN174	X	-	-	-	-	-	-	X	-	-	0.50	850
45BN175	X	-	-	-	-	X	-	-	-	X	----	----
45BN176	X	X	-	X	X	-	-	X	-	-	1.00	1,535
45BN177	X	-	X	-	X	-	-	X	-	-	0.50	900
45BN178	X	-	-	-	-	X	-	-	X	-	----	----
45FR266	X	-	-	-	X	X	X	X	-	-	1.00	1,535
45GR325	-	-	-	-	-	X	-	-	-	X	----	----
TOTALS	24	4	5	2	18	9	1	17	5	4	----	----

Summary of Site Types and Recommendations. An "X" mark identifies the proper categories for each site. Total sample equals 26 sites.

TABLE 010.6-1a

ARCHAEOLOGICAL SITE AND DESCRIPTION

SITE INDEX

The following is a catalog of 26 sites and three localities recorded by the reconnaissance. Table 1 summarizes the recommendations made for each site listed below.

Archaeological Sites

45BN101

This is an open camp site located on the southeastern end of the island opposite the old townsite of North Richland. ($SE\frac{1}{4}$ of the $NW\frac{1}{4}$ of Sec. 25, T.10N., R.28E., W.M.).

The site consists of concentrations of shell and camp rock. It is 100 feet long and about 50 feet wide.

Artifacts encountered include cobble tools.

Surface collection is recommended.

45BN102

This is an open camp site located on the east side of the island opposite the old townsite of North Richland. ($SW\frac{1}{4}$ of the $NW\frac{1}{4}$ of Sec. 24, T.10N., R.28E., W.M.).

The site consists of concentrations of shell and camp rock, and a hearth area exposed in the river bank. It is 300 feet long and 150 feet wide.

Artifacts include cobble hammerstones and a hopper mortar.

Test excavation is recommended.

45BN103

This is an open camp site located on the northeastern end of the island opposite the old townsite of North Richland. ($NW\frac{1}{4}$ of the $NW\frac{1}{4}$ of Sec. 24, T.10N., R.28E., W.M.).

The site consists of concentrations of camp rock. It is 150 feet long and about 75 feet wide.

Artifacts encountered include cobble tools and notched pebble sinkers.

Surface collection is recommended.

45BN104

This is an open camp site located on the west bank of the Columbia at the northeastern corner of the old townsite of North Richland. (Center of the $NE\frac{1}{4}$ of Sec. 14, T.10N., R.28E., W.M.).

The site consists of scattered concentrations of camp rock along the river bank. There is also some possibility of housepits back from the bank, but this is inconclusive due to considerable disturbance from the old construction camp at North Richland. The site is 350 feet long and about 150 feet wide.

Artifacts encountered include corner-notched projectile points, scrapers, cobble hammerstones, cobble tools, and hopper mortars.

Test excavation is recommended.

45BN105

This is a possible housepit site located on a sheltered bench 1.0 miles north of the old North Richland townsite. ($SW\frac{1}{4}$ of the $SE\frac{1}{4}$ of Sec. 11, T.10N., R.28E., W.M.).

The site consists of scattered concentrations of camp rock along the river bank and may include as many as four or five housepits on the beach above the bank. The site is about 200 feet long and 150 feet wide.

Artifacts encountered include cobble tools and a hopper mortar.

Test excavation is recommended.

45BN106

This is an open camp site located immediately to the southeast of the 300 area along the river bank. The new biology building will be constructed on the bench above the bank. (Center of Sec. 11, T.10N., R.22E., W.M.).

The site consists of scattered concentrations of camp rock, flakes, and shell. It is about 400 feet long and 150 feet wide.

Artifacts encountered include stemmed projectile points, cobble tools, and hopper mortars.

No further work is recommended.

45BN145

This is an ethnographically reported camp site located on the south bank of the Columbia opposite a large island upstream from Locke Island. ($NW\frac{1}{4}$ of Sec. 12, T.14N., R.26E., W.M.).

The site consists of three or four mat lodge depressions on a gravel bar close to water's edge. Much camp rock and many flakes are scattered around the encampment. The site was reportedly last occupied about 1915.

Artifacts encountered include cobble tools, hopper mortars, a chipped stone knife, corner-notched projectile points, and a grooved net weight.

Surface collection is recommended.

45BN162

This is an open camp site located along the river bank at the 300 area. ($SE\frac{1}{4}$ of the $SW\frac{1}{4}$ of Sec. 11, T.10N., R.28E., W.M.).

The site consists of scattered concentrations of camp rock, flakes, and shell. It is about 600 feet long and 150 feet wide.

Artifacts encountered include cobble tools, notched pebble sinkers, grooved net weights, hopper mortars, a glass trade bead, and a military button.

Surface collection is recommended.

45BN163

This is a possible housepit site located on the west bank of the Columbia just opposite the lower end of the island immediately upstream from the 300 area. ($E\frac{1}{2}$ of the $NW\frac{1}{4}$ of Sec. 2, T.10N., R.28E., W.M.).

The site consists of scattered concentrations of camp rock, flakes, shell. Several hearth areas are exposed in the bank and there are five or six oval-shaped depressions strung in a line on the bench above the bank, suggesting housepits. The site is about 400 feet long and 100 feet wide.

Artifacts encountered include cobble tools, hopper mortars, and a faceted blue-glass trade bead.

Test excavation is recommended.

45BN164

This is an open camp site located on the southern end of the island just upstream from the 300 area. (Center of Sec. 2, T.10N., R.28E., W.M.).

The site consists of scattered concentrations of camp rock, flakes, and shell. It is about 250 feet long and 200 feet wide.

Artifacts encountered include cobble tools, notched pebble sinkers, and corner-notched projectile points.

Test excavation is recommended.

45BN165

This site is a fishing station located on the west bank of the Columbia about 1.0 miles north

TABLE 010.6-1b

of the 300 area. (NE$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Sec. 35, T.11N., R.28E., W.M.).

The site consists of concentrations of cobble tools and notched pebble sinkers. It is about 125 feet long and 30 feet wide.

No further work is recommended.

45BN166

This is an open camp site located on the west bank of the Columbia about 1.7 miles north of the 300 area. (SW$\frac{1}{4}$ of the SE$\frac{1}{4}$ of Sec. 26, and the W$\frac{1}{2}$ of the NE$\frac{1}{4}$ of Sec. 35, T.11N., R.28E., W.M.).

The site consists of scattered concentrations of camp rock. Several hearth areas are eroding out of the bank. The site is about 300 feet long and 75 feet wide.

Artifacts encountered include cobble tools and a grooved net weight.

Test excavation is recommended.

45BN167

This is an open camp site located on the west bank of the Columbia about 2.1 miles north of the 300 area. (SW$\frac{1}{4}$ of the NE$\frac{1}{4}$ of Sec. 26, T.11N., R.28E., W.M.).

The site consists of concentrations of camp rock, flakes, and shell. Hearth areas are eroding out of the bank and it is possible that there are some filled-in house-pits on the bench above the bank. The site is about 350 feet long and 100 feet wide.

Artifacts encountered include cobble tools, notched pebble sinkers, hopper mortars, a contracted-stemmed projectile point, and a blue-glass trade bead.

Test excavation is recommended.

45BN168

This is a housepit site located about 100 yards south of the lower end of Wooded Island on the west bank of the Columbia, or approximately 2.4 miles north of the 300 area. (NW$\frac{1}{4}$ of the NE$\frac{1}{4}$ of Sec. 26, T.11N., R.28E., W.M.).

The site consists of four or five housepit depressions on a bench overlooking the river. It is about 100 feet long and 50 feet wide.

No artifacts were encountered.

Test excavation is recommended.

45BN169

This is a housepit site located on a bench on the west bank of the Columbia about 0.3 miles northeast of the Benton Substation. (NW$\frac{1}{4}$ of the NE$\frac{1}{4}$ of Sec. 11, T.11N., R.28E., W.M.).

The site consists of eight to 10 housepits and shows scattered concentrations of camp rock, flakes, and shell at the base of the river bank. It is 200 feet long and 150 feet wide.

No artifacts were encountered.

Test excavation is recommended.

45BN170

This is an open camp site located at Rattlesnake Springs, which lies at the terminus of Yakima Ridge. (SE$\frac{1}{4}$ of Sec. 20, T.12N., R.25E., W.M.).

The site consists of acattered concentrations of camp rock and flakes. It is severely eroded by wind deflation and is superimposed upon geological units which contain at least three volcanic ashes. It is about 600 feet long and 400 feet wide. Historically, this is the site of the Perkins Massacre which took place on or about July 10, 1878.

No artifacts were encountered.

Test excavation is recommended.

45BN171

This is an open camp site located about 0.2 miles east of Rattlesnake Springs on the north bank of Dry Creek. (Center of the SW$\frac{1}{4}$ of Sec. 21, T.12N., R.25E., W.M.).

The site consists of small quantities of camp rock and scattered flakes. It has been severely eroded by wind deflation. The site is about 300 feet long and 150 feet wide.

Two leaf-shaped points were encountered.

Test Excavation is recommended.

45BN172

This is an open camp site located about 0.25 miles from the mouth of Snively Canyon on the east side of the road. (NW$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Sec. 5, T.11N., R.25E., W.M.).

The site consists of scattered camp rock and flakes. It is about 150 feet long and equally wide.

Artifacts encountered include a corner-notched projectile point.

Test excavation is recommended.

45BN173

This is an open camp site located at the Snively Ranch. (NE$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Sec. 8, T.11N., R.25E., W.M.).

The site consists of a few flakes, bone fragments, and some firecracked rock exposed in a bank to the southwest of the ranch house about 30 feet. It is about 50 feet long and 30 feet wide.

Artifacts encountered include a pestle and a piece of worked antler.

Test excavation is recommended.

45BN174

This is an open camp site located on the western side of Honey Lake, just south of the western terminus of Gable Mountain. (SW$\frac{1}{4}$ of the NE$\frac{1}{4}$ of Sec. 22, T.13N., R.26E., W.M.).

The site consists of a concentration of camp rock and flakes. It has been severely eroded by wind deflation. The site is about 75 feet long and 50 feet wide.

Artifacts encountered include corner-notched and contracted-stemmed points, and a bifacially flaked cobble tool.

Test excavation is recommended.

45BN175

This is an open camp site located at a spring close to the summit of Rattlesnake Mountain. (SE$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Sec. 30, T.11N., R.26E., W.M.).

The site consists of scattered flakes on a rather rocky surface with a small amount of fill. The site has been largely destroyed by construction of a pumphouse and bulldozing for a road and transmission line. It is about 50 feet long and 30 feet wide.

Artifacts encountered include small stemmed and corner-notched projectile points.

No further work is recommended.

45BN176

This is an ethnographically reported camp site located about 0.2 miles east of 100-H area. (NW$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Sec. 17, T.14N., R.27E., W.M.).

The site consists of three or four mat lodge depressions on a gravel bar, and a cache of belongings in an adjacent bank. Much camp rock and a few flakes are scattered around the encampment. The site was last occupied about 1942.

No Artifacts were encountered.

Test excavation of the cache is recommended.

TABLE 010.6-1b

45BN177

This is an open camp site located at the old site of Columbia Camp, just west of the Horn of the Yakima River. (SE$\frac{1}{4}$ of Sec. 4, T.10N., R.27E., W.M.).

The site consists of scattered concentrations of camp rock, flakes, and shell. Along the upstream part of the site there is some possibility of housepits. The eastern end of the site has been destroyed, however, by bulldozing for a recreation area. It is about 800 feet long and 200 feet wide.

Artifacts encountered include cobble tools, corner-notched and small side-notched projectile points.

Test excavation at the west end of the site is recommended, otherwise no further work.

45BN178

This is an open camp site located on the west bank of the 100-F area slough in a sand dune. (NE$\frac{1}{4}$ of the NE$\frac{1}{4}$ of Sec. 4, T.13N., R.27E., W.M.).

The site consists of scattered concentrations of camp rock and flakes. It is about 400 feet long and 300 feet wide.

Artifacts encountered include a corner-notched projectile point.

Surface collection is recommended.

45FR266

This is a historic site located on the east bank of the Columbia opposite East White Bluffs townsite. (E$\frac{1}{2}$ of Sec. 29, T.14N., R.27E., W.M.).

The site consists of scattered concentrations of camp rock, flakes, and shell. In addition, the site is of historic interest because of a small log house which was reportedly built in the 1850's and used as a blacksmith shop. The site is about 2000 feet long and 500 feet wide.

Artifacts encountered include cobble tools, notched pebble sinkers, pestles, small corner-notched points, glass trade beads, and a clam shell disc bead.

Test excavation of the site and preservation of the log structure is recommended.

45GR325

This site is a flaking floor located on the Wahluke Slope above the White Bluffs and south of State Highway 11-A. (N$\frac{1}{2}$ of the NW$\frac{1}{4}$ of Sec. 6, T.14N., R.26E., W.M.).

The site consists of scattered cores and chipping detritus. These have been exposed by wind deflation on the tops and sides of small knolls along Northern Pacific Railway right-of-way.

Artifacts encountered include cores and corner-notched projectile points.

No further work is recommended.

Archaeological Localities

Gable Butte Locality

The Gable Butte locality lies a short ways to the south of 100-B and 100-K areas. It includes area in Sections 13 and 14, T.13N., R.25E., and Sections 18, 19, and 20, T.13N., R.26E., W.M.

Several flakes and rock piles were found along the top of the ridge at the western end of the locality.

Corner-notched projectile points were encountered from this locality.

Further surface examination is recommended.

Gable Mountain Locality

The Gable Mountain Locality lies to the northeast of 200-E area. It includes area in Sections 13, 14, 15, 22, 23, 24, T.13N., R.26E., and Sections 18, 19, 20, and 21, T.13N., R.27E., W.M.

Relander (1956:306) reports that this locality was one of the principal places where Indian boys and girls were sent on their spirit quests.

A corner-notched projectile point was encountered.

Further surface examination is recommended.

The Shifting Dunes Locality

The Shifting Dunes locality lies along the west bank of the Columbia opposite Ringold Flat and the lower end of Savage Island. It includes area in Sections 8, 9, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, and 28, T.12N., R.28E., W.M.

This locality evidently contains numerous small camp sites that have been deflated by wind erosion and then buried by the shifting sands.

Corner- and basal-notched projectile points were encountered.

Further surface examination is recommended.

TABLE 010.6-1b

WAC 463-12-010(6) - GENERAL (Supp. filing 7/1/71)

The routing and conceptual design of the three transmission lines to be constructed between the plant site and their interconnecting points with the existing northwest grid are described by the July 1, 1971 supplemental filing in Section 010 (4) and are illustrated by the Figure 010-1 (revised July 1, 1971). The corridors, as defined, confirm that the historical sites and archaeological localities identified by Battelle Pacific Northwest Laboratories and tabulated in Table 010.6-1a will not be physically affected by the Project or the Project's transmission line right-of-ways.

The three transmission lines are scheduled to be constructed during the period January 1, 1974 through January 1, 1977.

Similar to the Supply System policy for archaeological treatment at the Hanford No. 2 Site proper, the Supply System will retain the services of an archaeologist in the event there is any evidence a historical site is to be disturbed or otherwise affected by the construction or operation of the Project transmission lines. If a disturbance is caused to an archaeological site due to transmission line construction, the Supply System consulting archaeologist will, in consultation with the Thermal Power Plant Site Evaluation Council, make the necessary arrangements for any preservation and/or interpretation.

The Supply System will report to the Council any evidence of archaelogical findings during the course of excavation and construction of the Hanford No. 2 Project and its associated transmission lines.

(7) Furnish an estimated investigation, planning and construction schedule flow chart expressing in months the time to execute and complete the several phases of planning and construction work. Give an approximate starting date of actual construction and operation.

The investigation, planning and construction schedules for the Project are designed to assure achievement of the completion of the Project by September 1977 in order to meet the regional power deficiency existing at that time. Because of the inter-utility coordination which underlies the Pacific Northwest's Hydro-Thermal Power Program, the failure of any project sponsor to meet the required completion schedules will have serious detrimental impact on the electrical power users of the State of Washington and the region. The Pacific Northwest's Hydro-Thermal Power Program is described in the "Official Statement," Exhibit 4.

A schedule for Site investigation, planning and construction of the Project, and the principal controlling dates are as follows:

Engineering Underway	June 1970
Participant Contracts Signed	January 1971
Site Selection	January 1971
File Application with Washington Thermal Power Plant Site Evaluation Council	January 1971
Receive Nuclear Steam Supply System Bids	January 1971
Complete Interim Financing	February 1971
Siting Council Informational and Zoning Hearings	March 1971
Award Nuclear Steam Supply System Contract	April 1971

Completion of Public Hearing Before State Siting Council	October 1971
State Site Certification	January 1972
Site Preparation	January 1972
AEC Hearings	August 1972
Receipt of AEC Construction Permit	September 1972
Complete Financing & Initiate Construction	October 1972
Delivery of Reactor Vessel	July 1975
Delivery of Turbine Generator	September 1975
Plant Tests	January 1977
Fuel Loading	April 1977
Commercial Operation	September 1977

The summary schedule for completion of the Project, prepared by Burns and Roe, Inc., is shown in Figure 010-7.

WAC 463-12-010 - GENERAL (Supp. Filing 9/27/71)

A critical path summary schedule for Hanford No. 2 construction is shown in Supplemental Filing 9-28-71, Figure 010-9. This chart shows controlling dates for the beginning and completion of construction for principal project structures, and installation of major plant components following issuance of an AEC Construction Permit, which is expected by February 15, 1973.

Any delays resulting from late deliveries or issuance of key permits could have profound adverse effect on the Project meeting the operational date of September 1977.

(8) Finance studies, related to the site, approved by the Council and agreed to by the applicant. These studies may include, but not be limited to, data gathering and research on biological; ecological, meteorological, geological, hydrological and general environmental problems. (Sec. 7, Chap. 45, Title 80 RCW)

The proposed Site was selected by reason, among others, of the availability of twenty-five years of study of the entire AEC Reservation area. The study by the AEC, its contractors, other federal and state governmental agencies, educational institutions, foundations and other organizations, has been concerned with data gathering and research on biological, ecological, meteorological, hydrological and general environmental problems of the area, among other things.

As a result, the studies and data that have been accumulated afford the Supply System and the Council with complete background data concerning flora, fauna, fisheries, wildlife and all receptor media. The studies also provide, in great detail, any necessary information concerning the limited effect of the prior nuclear reactor activities on the river, ground water, land areas, population and receptor media in and adjacent to the Hanford Reservation.
The leading papers and studies which are available for consideration in connection with this application are described in the bibliography included at the end of each Section. Data which is included in the bibliography can be used by the Council and the Supply System in connection with the consideration of this application and is summarized as follows:

Meteorology

A record and history of atmospheric stability, air temperature, wind velocity, wind direction, precipitation, cloud cover, relative humidities and solar radiation.

Geology

Detailed studies of subsurface composition, land formation, load bearing characteristics and subsurface data from more than 1,500 wells.

Hydrology

Twenty-five years of ground water studies, tables and flows, and computer model for ground water simulation techniques.

Seismology

Earthquake history of Hanford and surrounding regions, plus detailed studies and instrumentation to determine presence and activity of earth movement, geologic research and ground motion and response studies.

Aquatic Ecology

Columbia River studies of aquatic life forms, effect of river temperatures and related laboratory studies of Columbia River life.

Terrestrial Ecology

Studies of life forms on the ground and in the air, effects of radioisotopes from fallout on life forms, and long term studies on life forms in the 120 square mile Arid Land Ecological Reserve.

Columbia River

Studies of composition, flow rates, mixing and temperature, river temperature predictions, and current and flow patterns.

WAC 463-12-010(8) - GENERAL (Supp. filing 10/12/71)

The planning and design of Hanford No. 2 has required a substantial amount of data gathering, research and studies on ecological and site related factors. In addition, the extensive evaluation of the Hanford No. 2 effects upon the local and regional environment has required that the Supply System engage in a number of in-depth studies and investigations to provide the type of data and information contained in the various sections of this application before the Thermal Power Plant Site Evaluation Council. By the act of filing this Application TPPSEC 71-1, the Supply System is obligated to finance studies, related to the Site, approved by the Council and agreed to by the Applicant.

In addition to members of its own staff, the Supply System has utilized independent consulting firms and individuals specializing in various disciplines to assess pertinent aspects of Hanford No. 2 plans, the Site and its interaction with the local and regional environment. The principal consulting firm, the assignment and the approximate cost to accomplish this program have included:

CONSULTANT	TITLE
Burns & Roe, Inc., Oradell, N. J.	Architect-Engineer
Site selection studies and reports, Environmental protection plans and facilities, Economic cost benefit ratio studies, Safety Analysis and other studies as assigned.	
R. W. Beck & Assoc., Seattle, Wa.	Consulting Engineer
Meteorological investigations, Investigation of alternative discharge methods,	

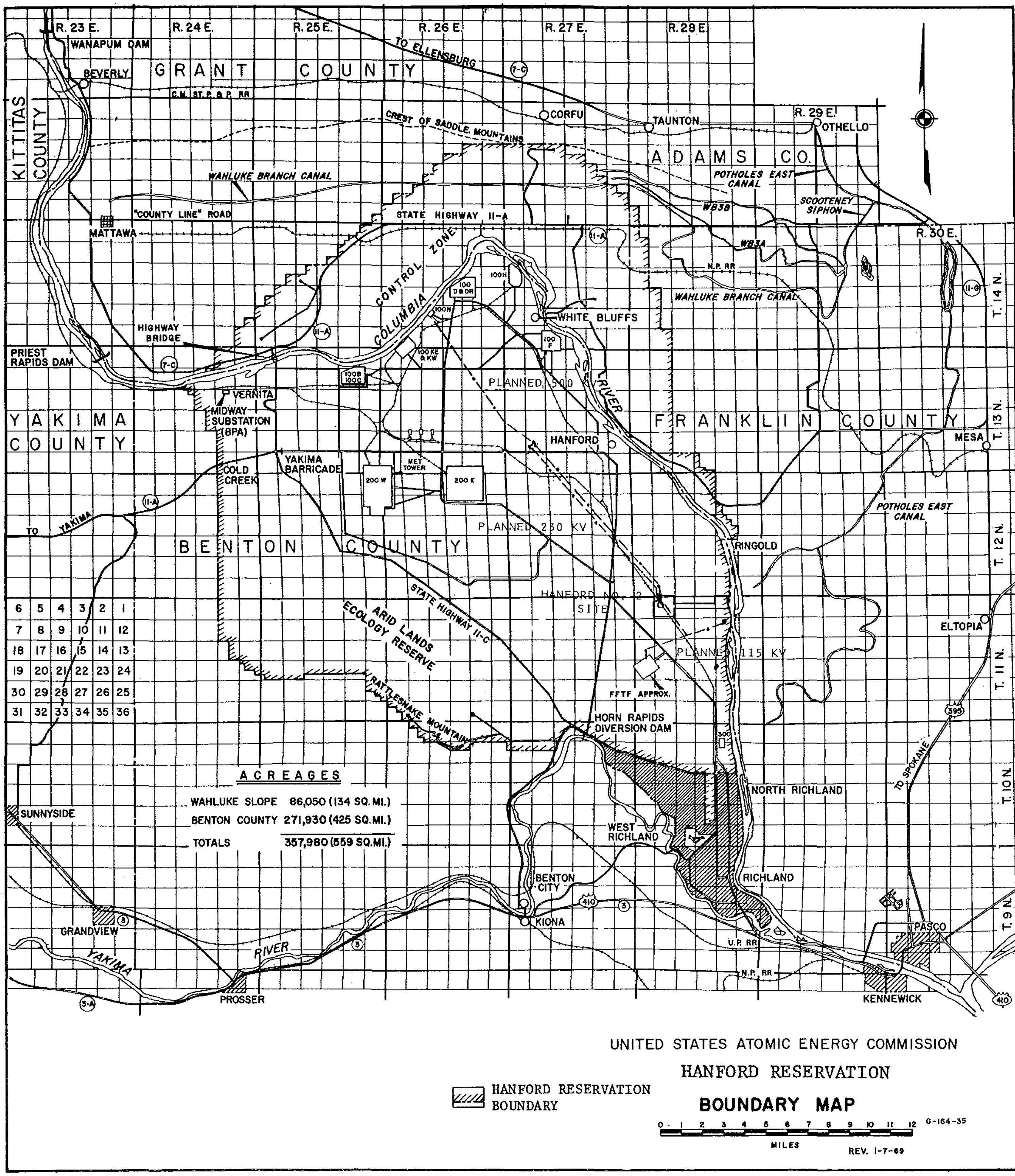
Economic alternatives,
Site studies, and
Cost estimates.

Pacific Northwest Laboratories-Battelle Richland, Wa.	Ecological Sciences Consultant
Studies and research of cooling ponds, Meteorological evaluation of the effects of cooling towers,	
Hydrology studies of Hanford No. 2 at various site locations.	
Douglas United Nuclear, Richland, Wa.	Ecological Sciences Consultant
Site studies	
Walker & Associates	Photogrammetric Contractor
Photogrammetric surveys of Hanford No. 2 site	
A. D. Stanley & Associates	Contractor
Site Survey	
Shannon & Wilson, Inc.	Soil Mechanics & Foundation Engineers
Geophysical consultant, Foundation investigations for Hanford No. 2 plant facilities.	
Hatch Drilling	Contractor
Soil borings	
Weston Geophysical Engineers, Inc. Weston, Massachusetts	Geophysical Consultant
Geophysical studies and report, Seismic velocity and elastic moduli measurements	
Scientific Systems and Technology	Geophysical Contractor
Soil permeability studies and report	
Dr. Howard Coombs, University of Wash. Seattle, Wa.	Geological Consultant
Design consultation services	

Randall E. Brown, Pasco, Wa. Geological consultant services	Geological Consultant
Dr. W. Kelly Woods, Richland, Wa. Environmental program consultant	WPPSS Staff Consultant
General Electric Company, Atomic Power Equipment Dept., San Jose, California Radiological design consultant services.	Nuclear Consultant
Nuclear Engineering Co. Site study consultant	Nuclear Consultant

It should be emphasized that there are a number of professional disciplines not specifically mentioned in the above tabulation, since several of the above consultants/contractors furnish consulting and design assistance in many engineering, environmental and ecological programs. The total Supply System investment in designs, studies, research and plans for Hanford No. 2 through September 1971 total approximately $2,658,000.

A breakdown of the Supply System total plant investment and a separate statement of the Hanford No. 2 environmental protection is contained in Section 050 - ECONOMICS AND FINANCES.



GRANT COUNTY
KITTITAS COUNTY
ADAMS CO.
YAKIMA COUNTY
FRANKLIN COUNTY
BENTON COUNTY
WANAPUM DAM
BEVERLY
CORFU
TAUNTON
OTHELLO
MATTAWA
PRIEST RAPIDS DAM
VERNITA
MIDWAY SUBSTATION (BPA)
WHITE BLUFFS
HANFORD
MESA
RINGOLD
ELTOPIA
HORN RAPIDS DIVERSION DAM
NORTH RICHLAND
WEST RICHLAND
RICHLAND
BENTON CITY
KIONA
GRANDVIEW
SUNNYSIDE
PROSSER
PASCO
KENNEWICK
ACREAGES
WAHLUKE SLOPE 86,050 (134 SQ.MI.)
BENTON COUNTY 271,930 (425 SQ.MI.)
TOTALS 357,980 (559 SQ.MI.)
HANFORD RESERVATION BOUNDARY
UNITED STATES ATOMIC ENERGY COMMISSION
HANFORD RESERVATION
BOUNDARY MAP
MILES
G-164-35
REV. 1-7-69

Figure 010-1

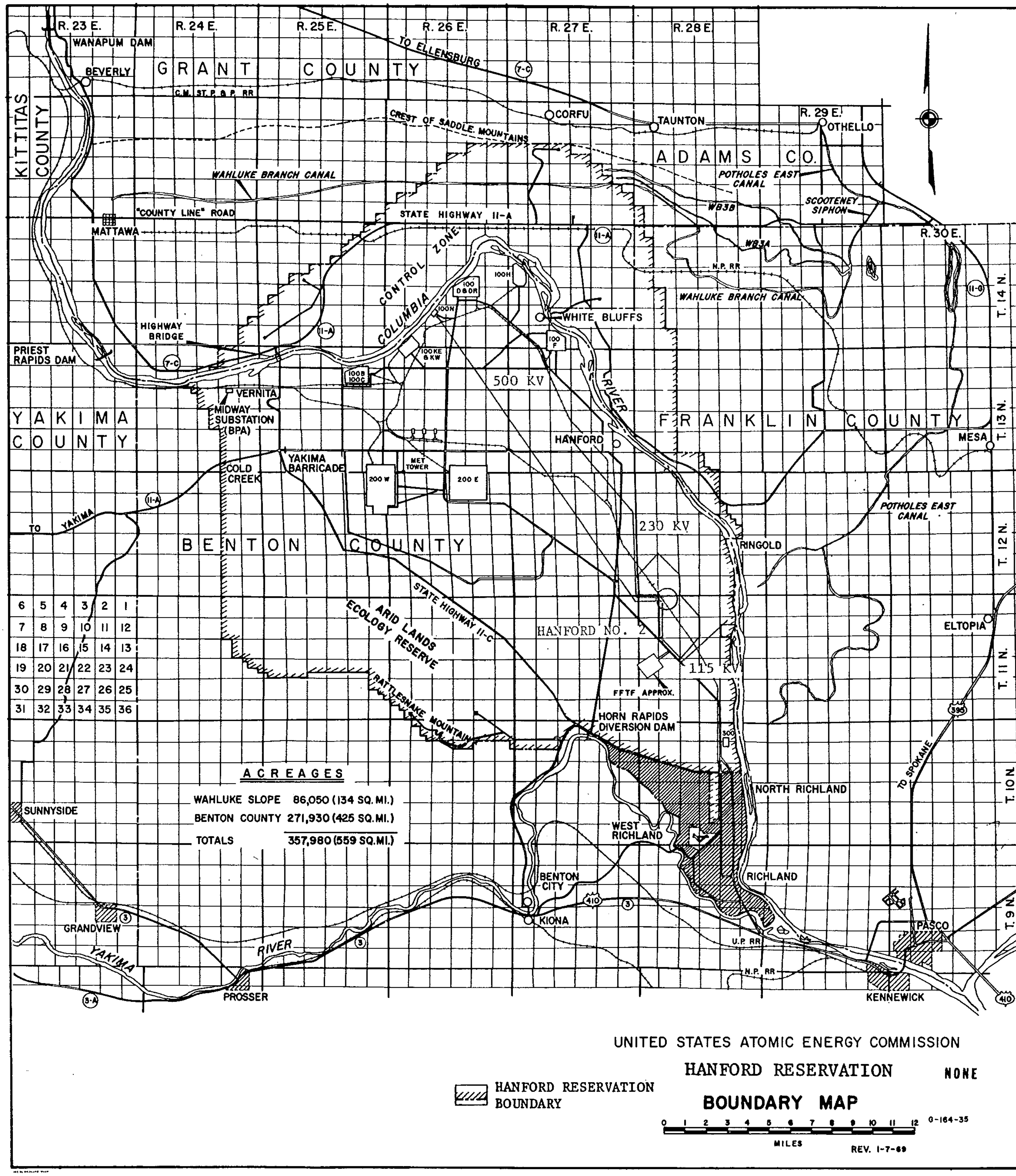


Figure 010-1 Supp. Filing 7/1/71

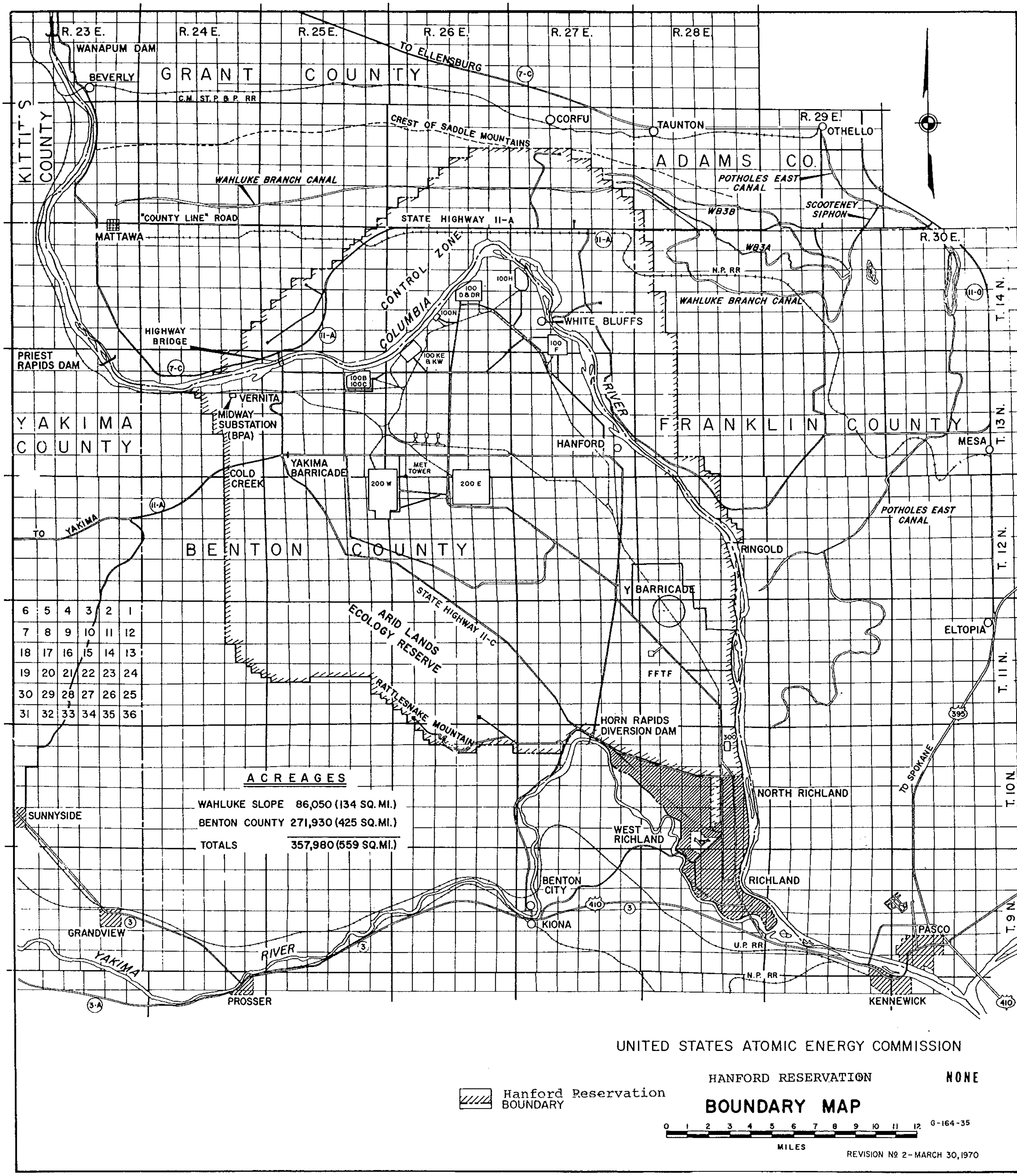
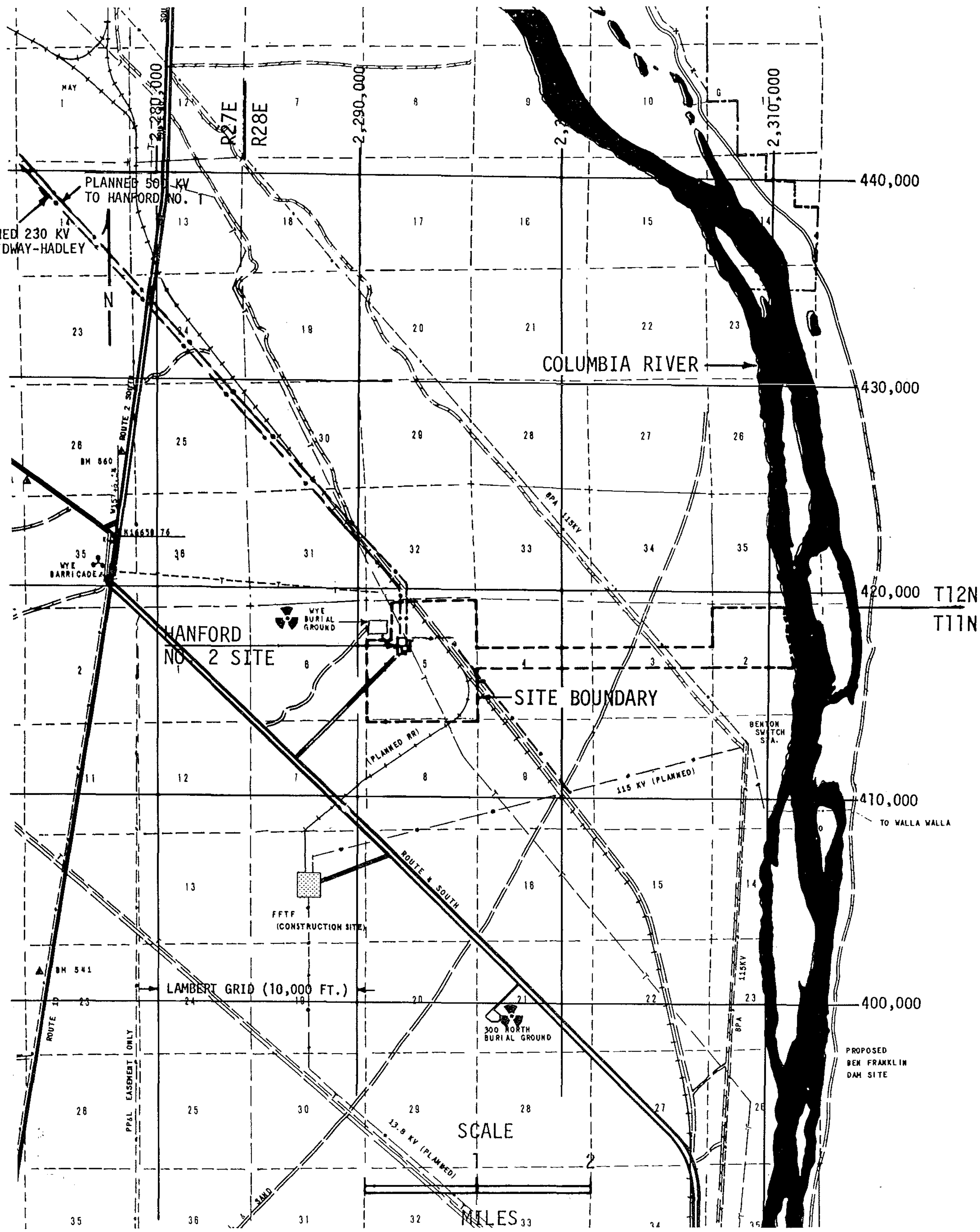
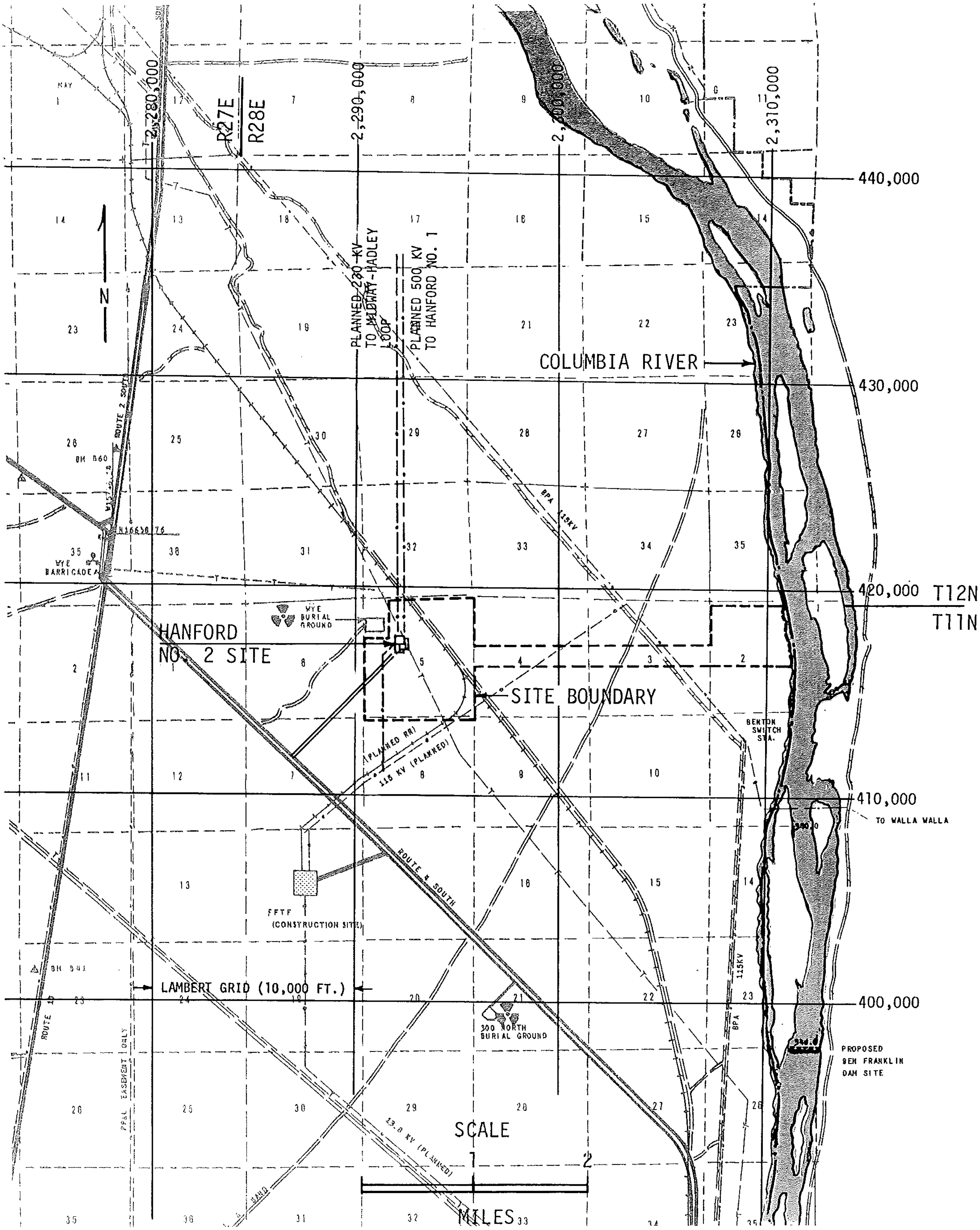

R. 23 E.
R. 24 E.
R. 25 E.
R. 26 E.
R. 27 E.
R. 28 E.
R. 29 E.
R. 30 E.
T. 14 N.
T. 13 N.
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
WANAPUM DAM
BEVERLY
GRANT COUNTY
TO ELLENSBURG
C.M. ST. P. & P. RR
KITTITAS COUNTY
CORFU
TAUNTON
OTHELLO
CREST OF SADDLE MOUNTAINS
ADAMS CO.
WAHLUKE BRANCH CANAL
POTHOLES EAST CANAL
SCOOTENEY SIPHON
WB3B
WB3A
"COUNTY LINE" ROAD
STATE HIGHWAY 11-A
MATTAWA
CONTROL ZONE
COLUMBIA
RIVER
N.P. RR
100H
100 D & DR
100N
WHITE BLUFFS
100 F
100 KE & KW
100B 100C
HIGHWAY BRIDGE
PRIEST RAPIDS DAM
VERNITA
MIDWAY SUBSTATION (BPA)
YAKIMA COUNTY
FRANKLIN COUNTY
HANFORD
MESA
COLD CREEK
YAKIMA BARRICADE
MET TOWER
200 W
200 E
TO YAKIMA
POTHOLES EAST CANAL
BENTON COUNTY
RINGOLD
Y BARRICADE
STATE HIGHWAY 11-C
ARID LANDS ECOLOGY RESERVE
ELTOPIA
FFTF
RATTLESNAKE MOUNTAIN
HORN RAPIDS DIVERSION DAM
300
NORTH RICHLAND
TO SPOKANE
ACREAGES
WAHLUKE SLOPE 86,050 (134 SQ. MI.)
BENTON COUNTY 271,930 (425 SQ. MI.)
TOTALS 357,980 (559 SQ. MI.)
SUNNYSIDE
WEST RICHLAND
BENTON CITY
RICHLAND
KIONA
GRANDVIEW
YAKIMA
RIVER
U.P. RR
N.P. RR
PASCO
PROSSER
KENNEWICK
UNITED STATES ATOMIC ENERGY COMMISSION
HANFORD RESERVATION
NONE
Hanford Reservation BOUNDARY
BOUNDARY MAP
MILES
G-164-35
REVISION № 2 - MARCH 30, 1970

Figure 010-1

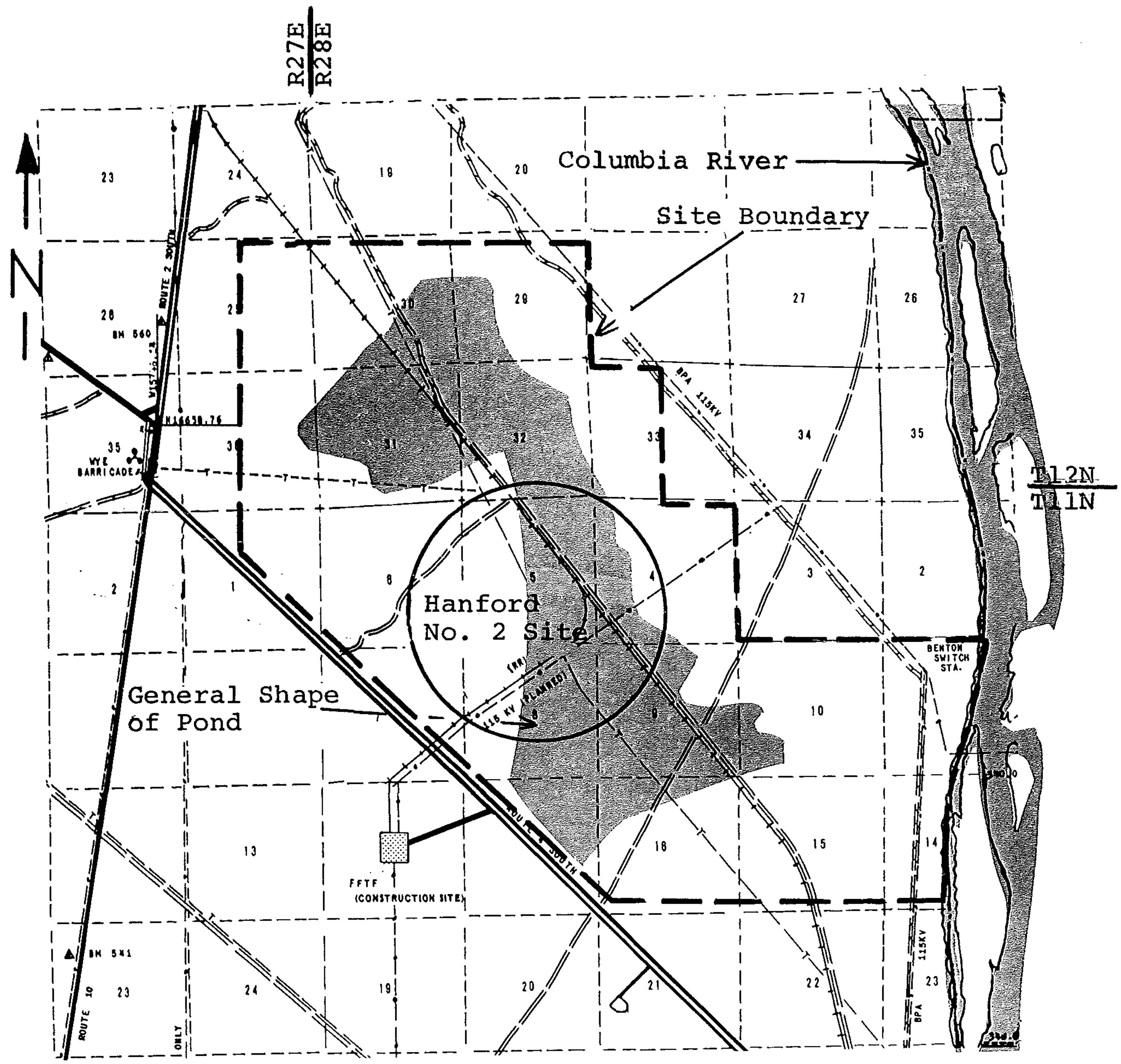


PROPOSED PROJECT SITE AND BOUNDARY
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

Figure 010-2



PROPOSED PROJECT SITE AND BOUNDARY
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2
Figure 010-2

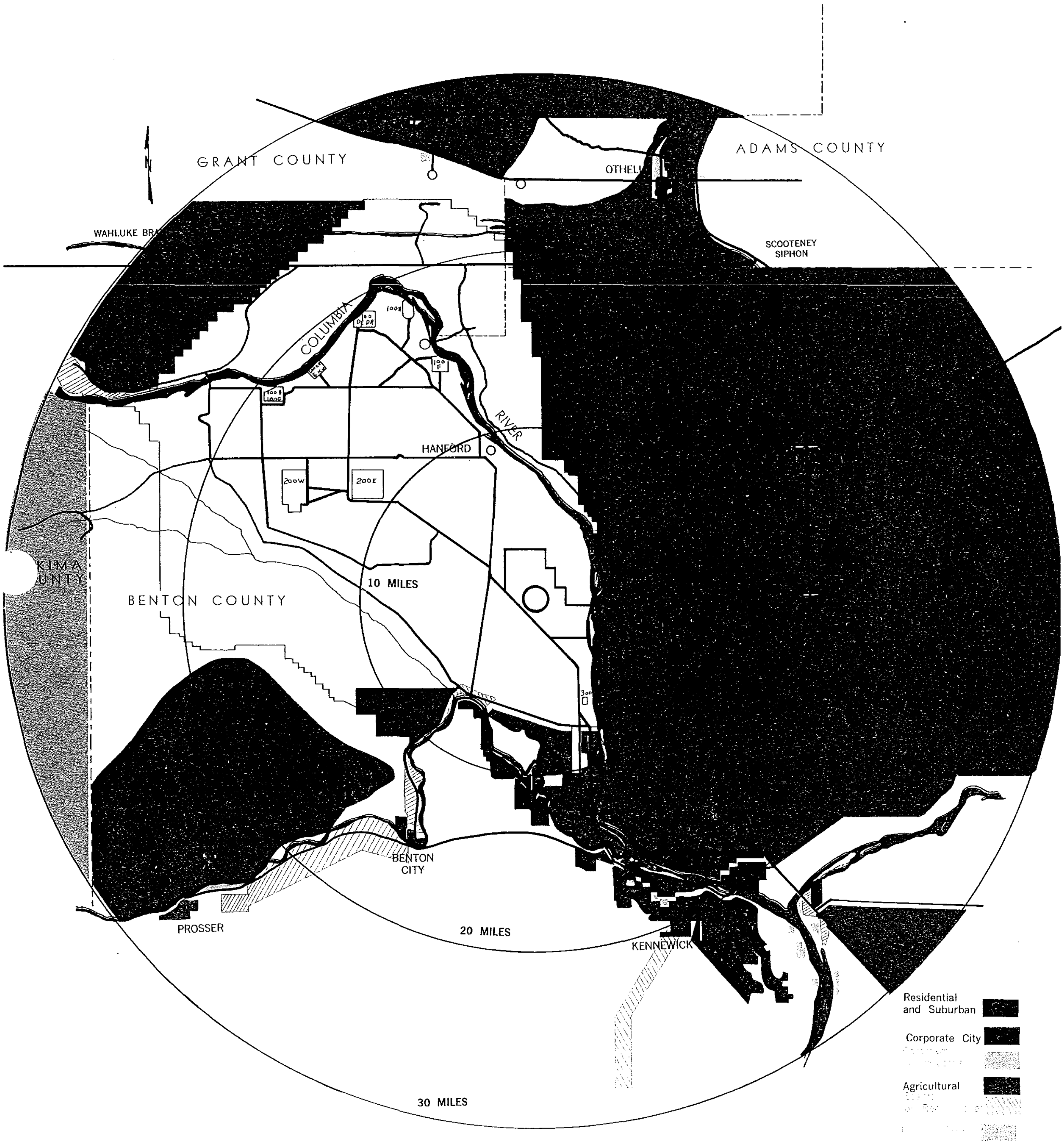


PROPOSED PROJECT SITE AND BOUNDARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

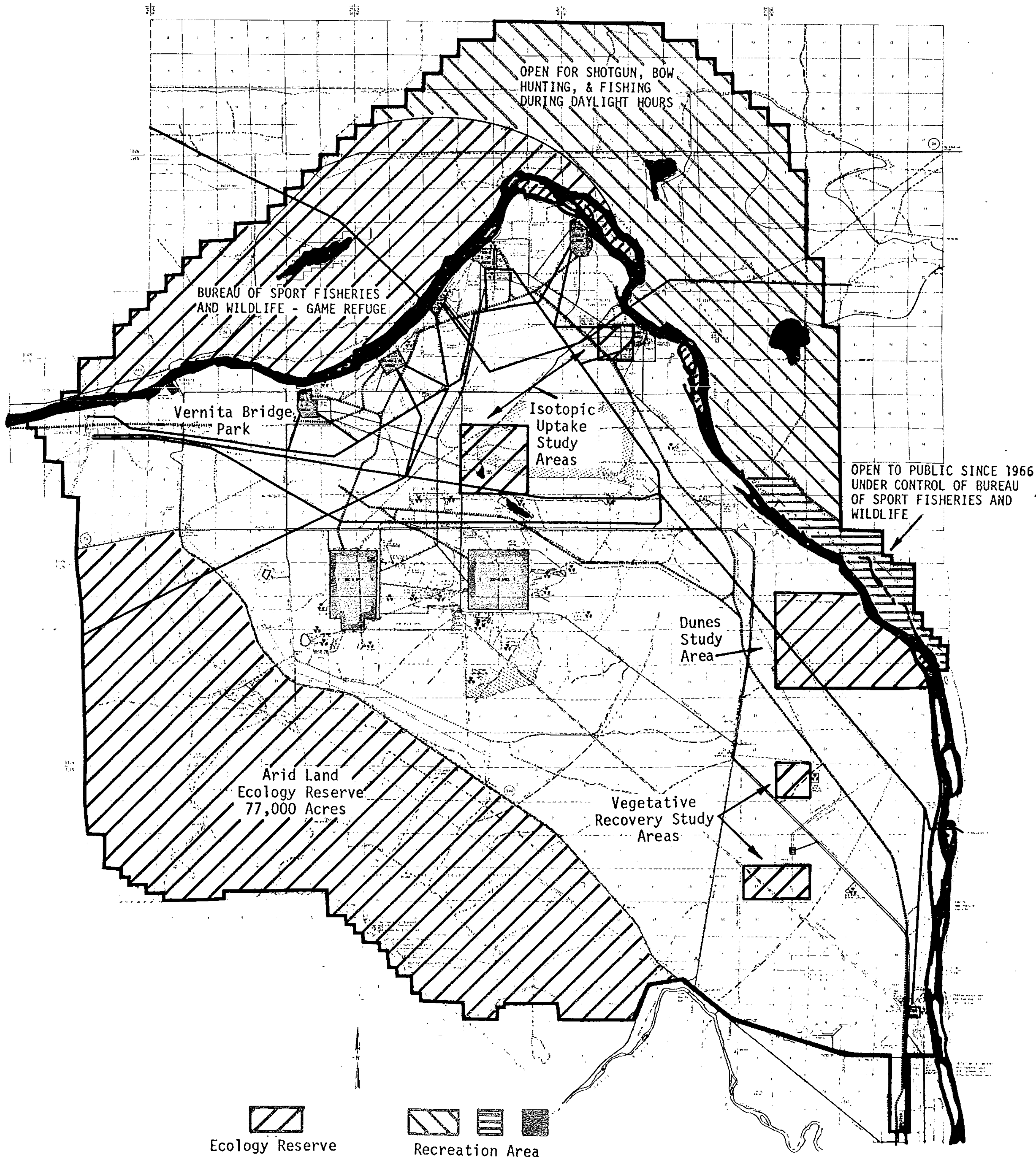
HANFORD NO. 2

Figure 010 - 2



SITE ZONING STATUS

Figure 010-3

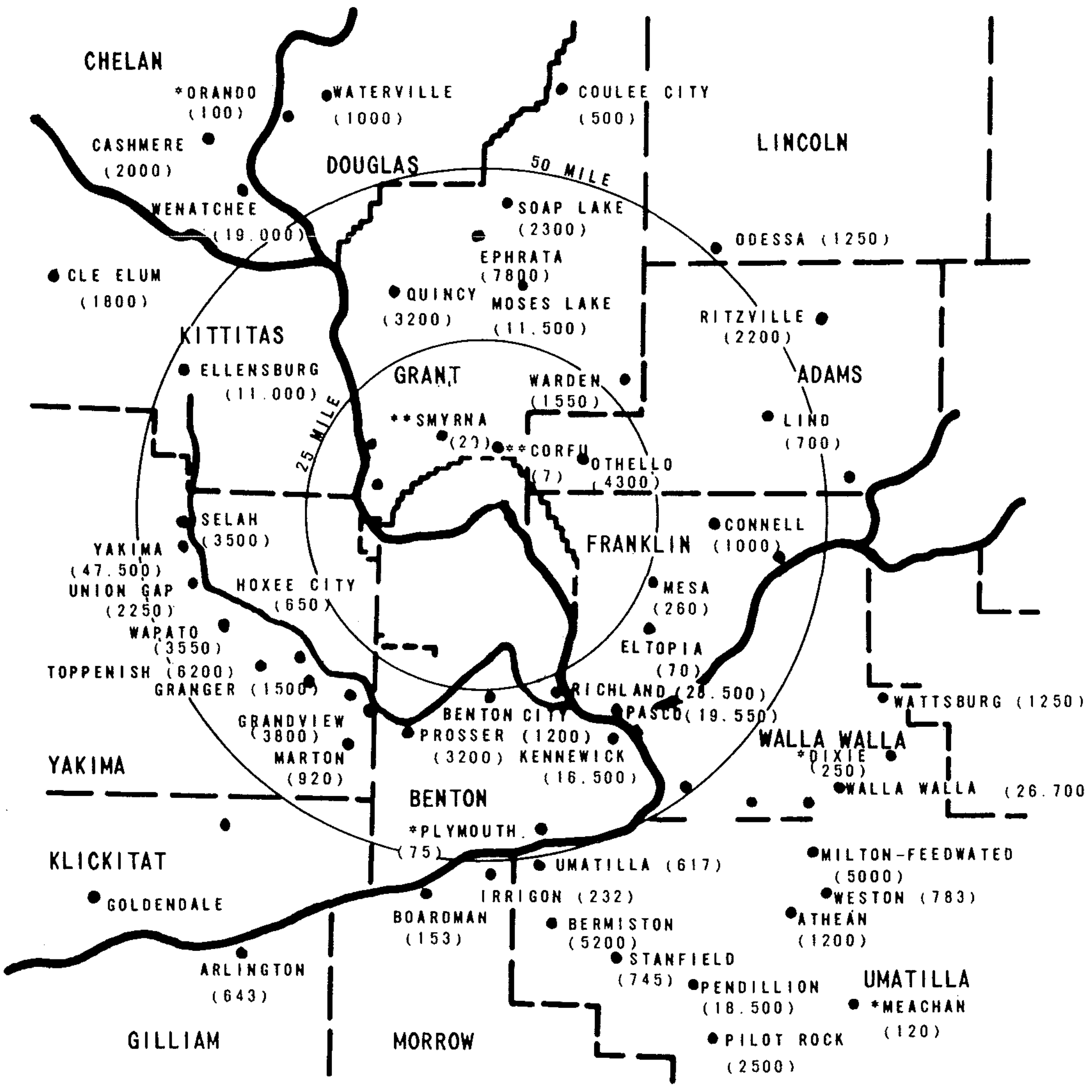


HANFORD RESERVATION LAND USES

Figure 010-4


Undedicated, Controlled Access and Restricted Use. 37,000 Acres.
49,000 Acre Primary Control Zone (Grazing Land)
Vernita Bridge Park
Isotopic Uptake Study Areas
Controlled Huntir
,000 Acres
Dunes Study Area
Arid Land Ecology Reserve 77,000 Acres
Vegetative Recovery Study Areas
HANFORD RESERVATION LAND USES
Ecology Reserves
Primary Control Zone
Recreation Area
Undedicated, Controlled Use

Figure 010-4



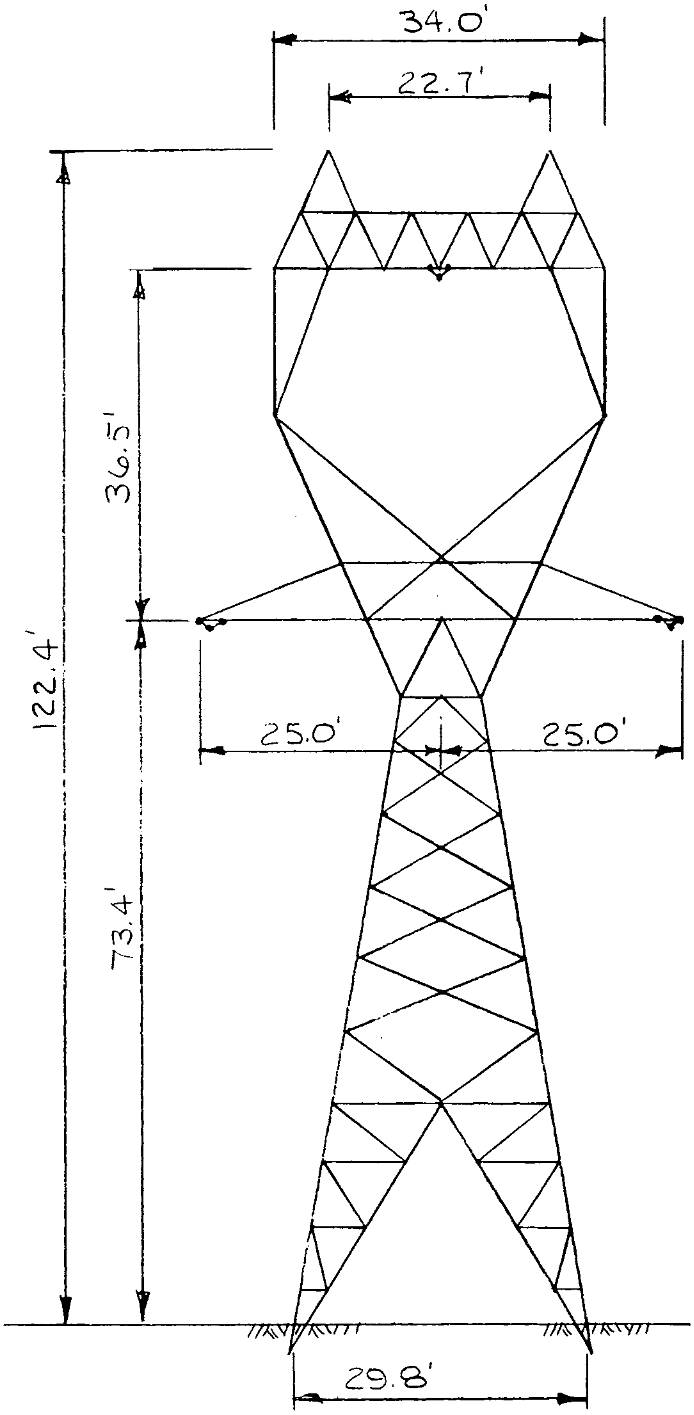
SOURCES FOR POPULATION DATA:

* RAND McNALLY CO. COMMERCIAL ATLAS AND MARKETING GUIDE (1969)

** WASHINGTON STATE HIGHWAY DEPARTMENT ESTIMATES (1969)
ALL OTHERS ARE ESTIMATES FROM THE WASHINGTON STATE CENSUS BOARD (1970)

Population Distribution in a 25 and 50 Mile Radius Around the Site

Figure 010-5



TOWER TYPE	38DL
TOWER WEIGHT	
INSTALLED COST	
DESIGN LINE ANGLE	0°-30°

NO.	*ORIG.	REVISION	BY	DATE	APPROVED

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
HEADQUARTERS, PORTLAND, OREGON

500 KV SINGLE CIRCUIT
TRANSMISSION TOWERS
DELTA CONFIGURATION
3-ACSR BUNTING PER PHASE

Des:
Dr: RYS
Ck:
Sub. D C Henry
APPROVED:
Date Ch. Br. Trans. Design
Date 5-22-70 Sh 1 of 1

Dwg. TD-2224-D

DRAWING NO.	SHEET	TITLE
REFERENCE DRAWINGS		

TA-69

Figure 010-6

SUMMARY SCHEDULE

HANFORD NO. 2 NUCLEAR GENERATING PLANT

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

BENTON COUNTY, WASHINGTON

BURNS AND ROE, INC.
W.O. 2808-03
JAN. 15, 1971

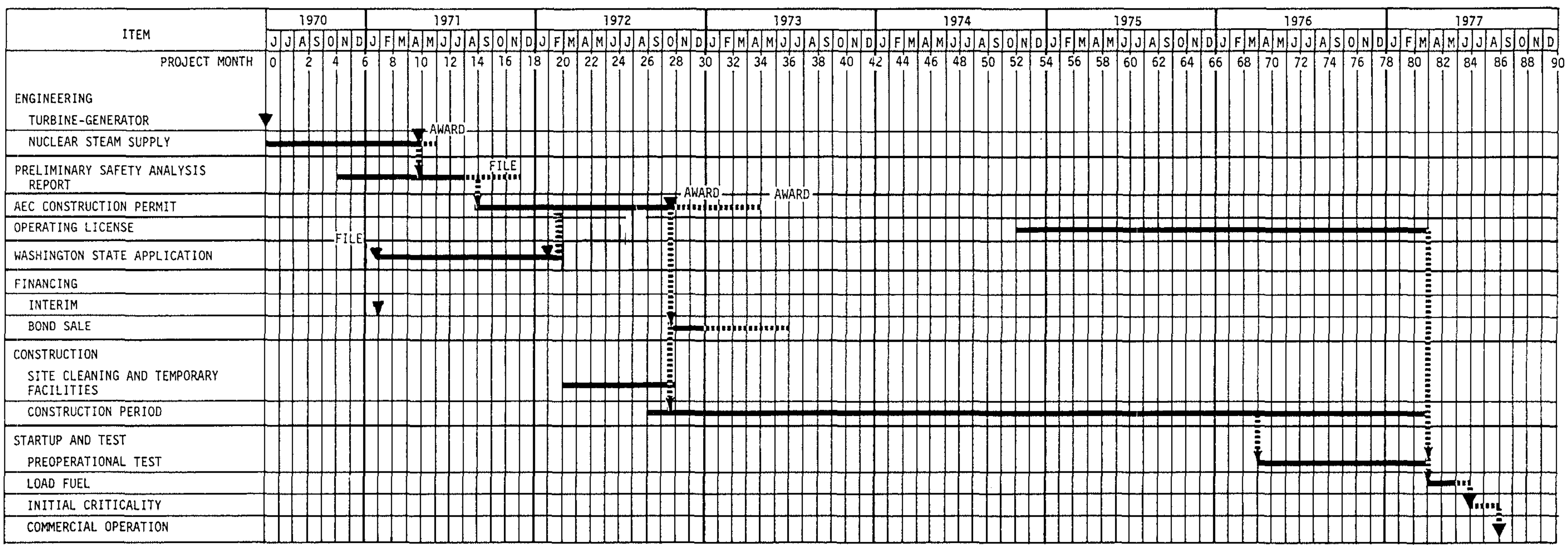
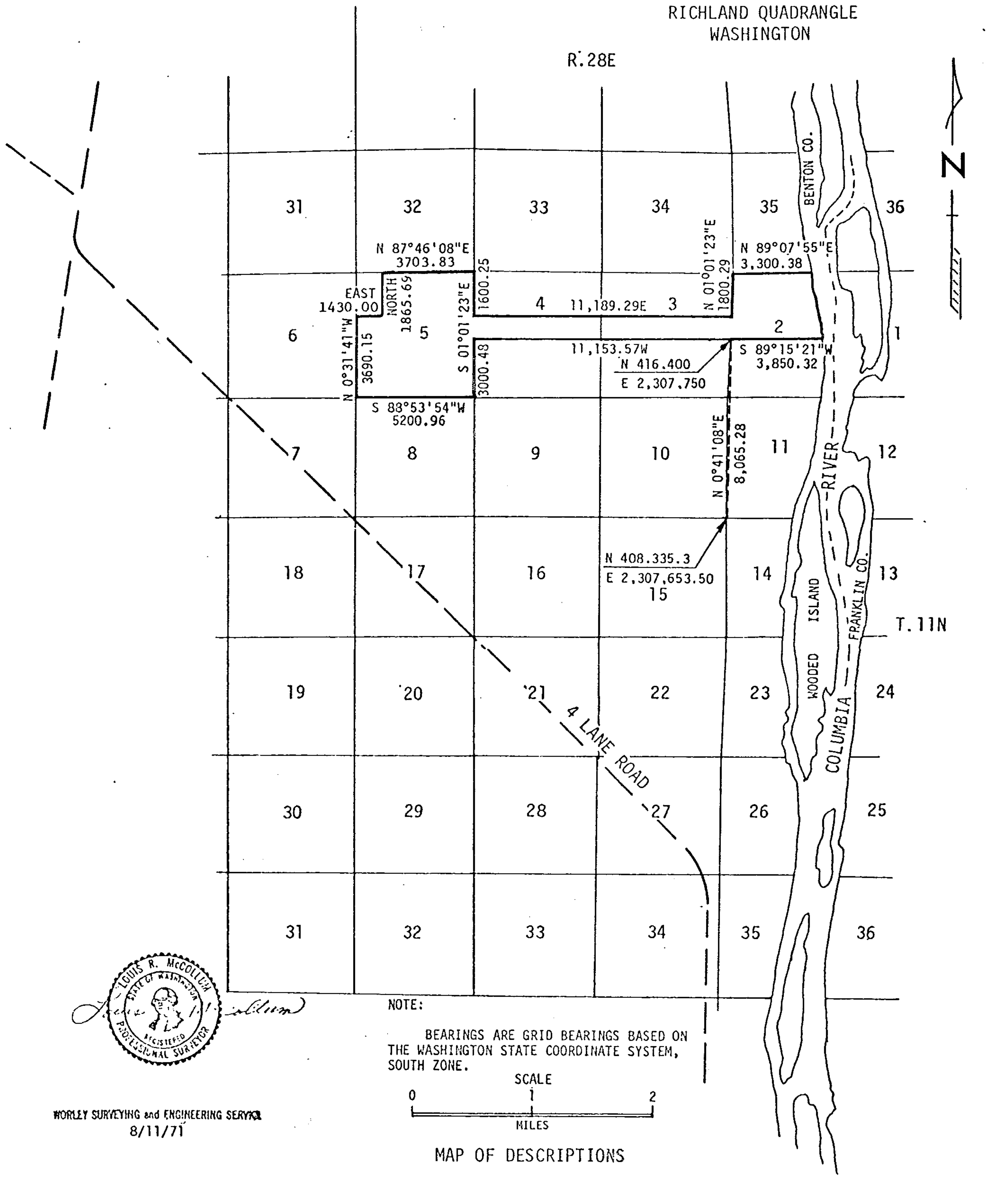


Figure 010-7

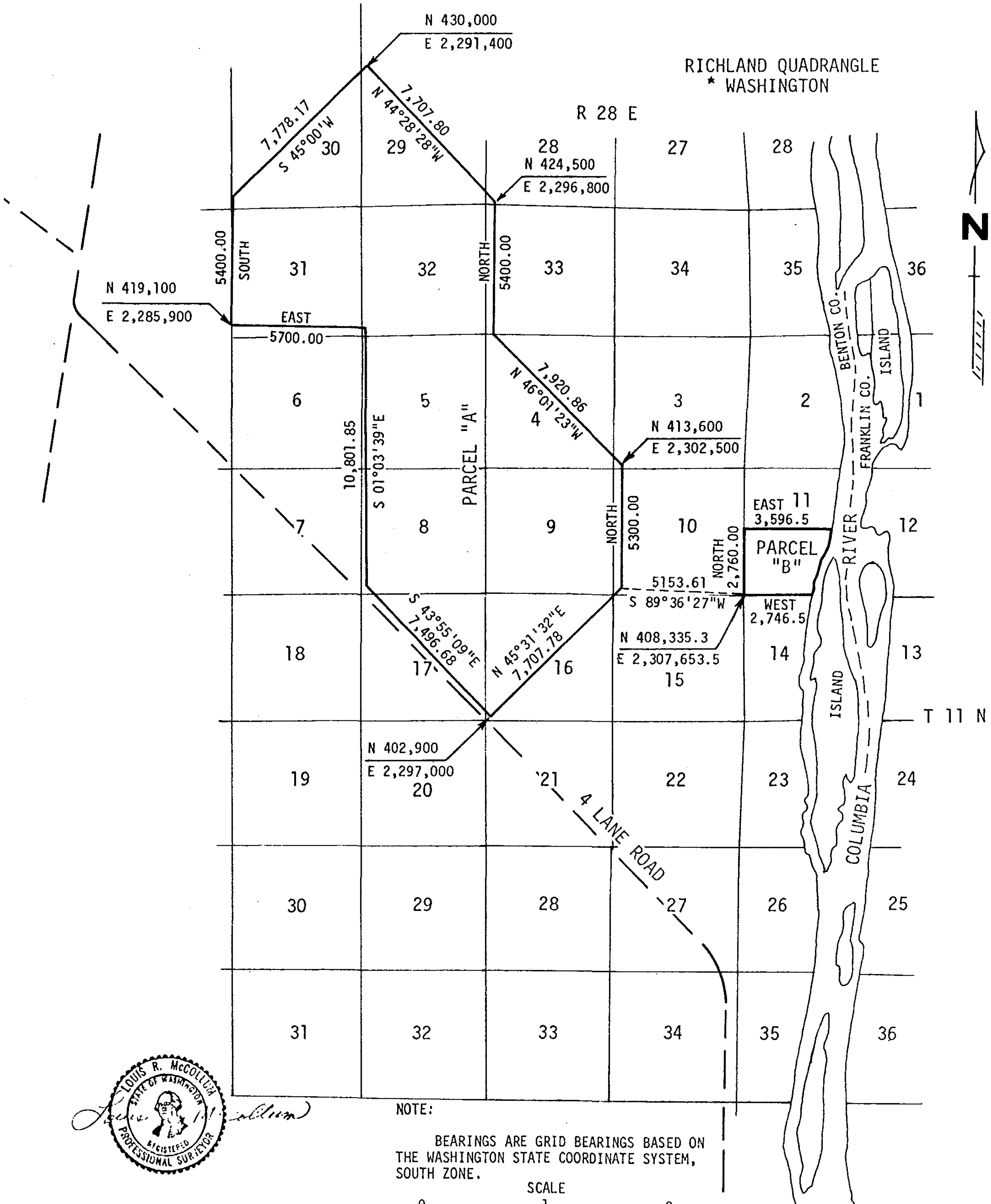


MAP OF DESCRIPTIONS

FOR

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Figure 010-8



WORLEY SURVEYING and ENGINEERING SERVICE
6-25-71
REV. PARCEL B - 6-30-71

MAP OF DESCRIPTIONS

FOR

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Figure 010-8

Supp. Filing 7/1/71

SUMMARY SCHEDULE

(September 27, 1971)

HANFORD NO. 2 NUCLEAR GENERATING PLANT

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Benton County, Washington

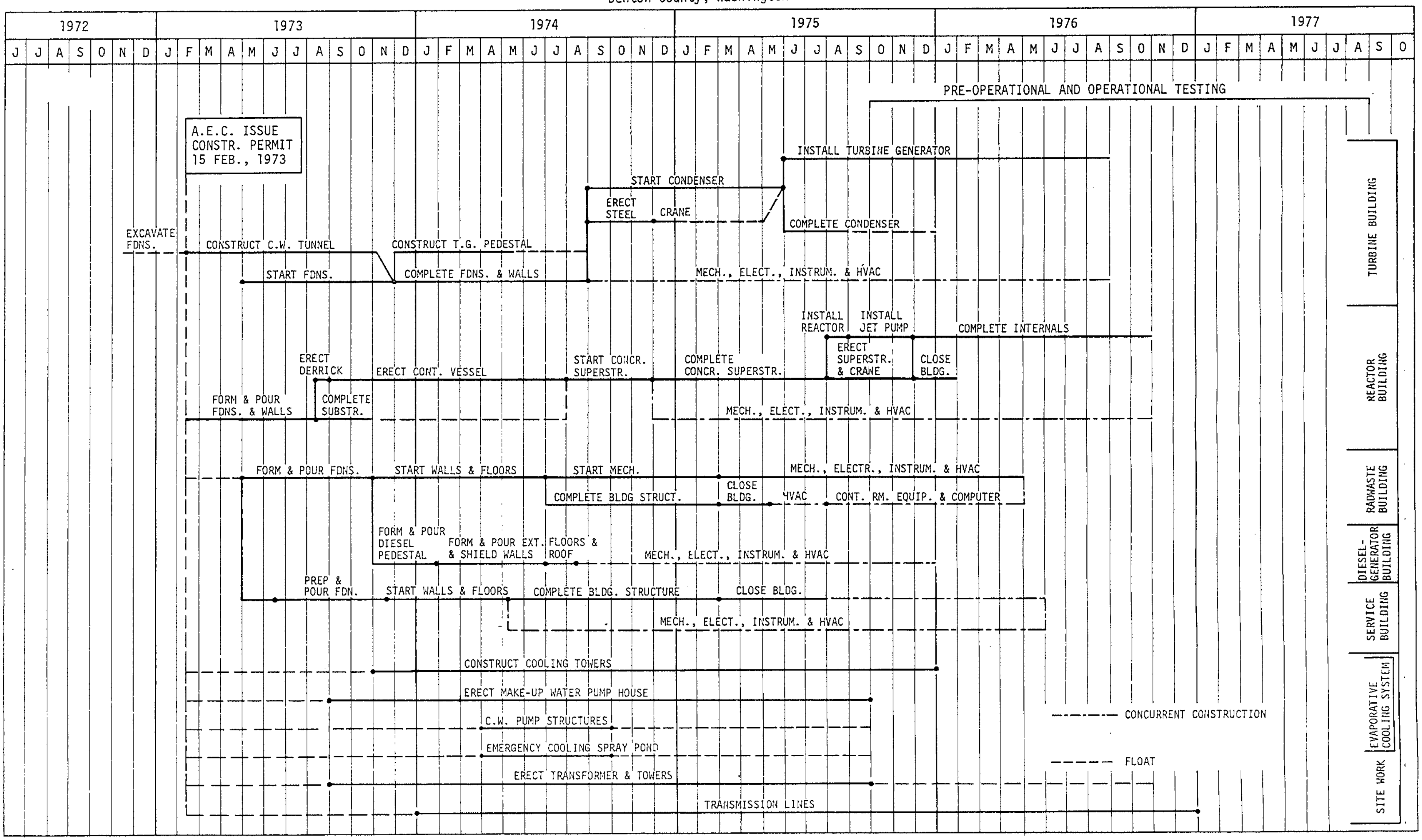
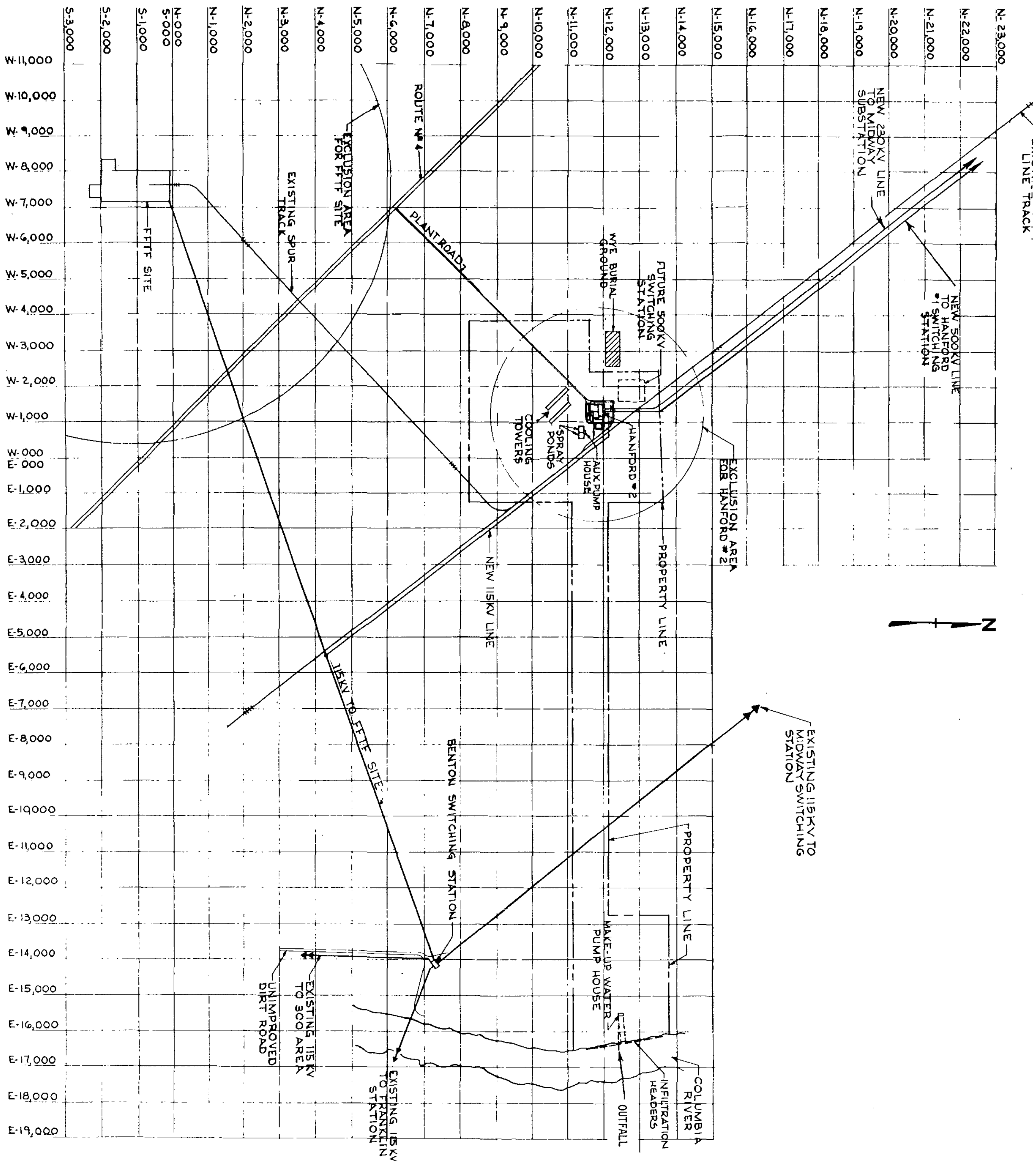
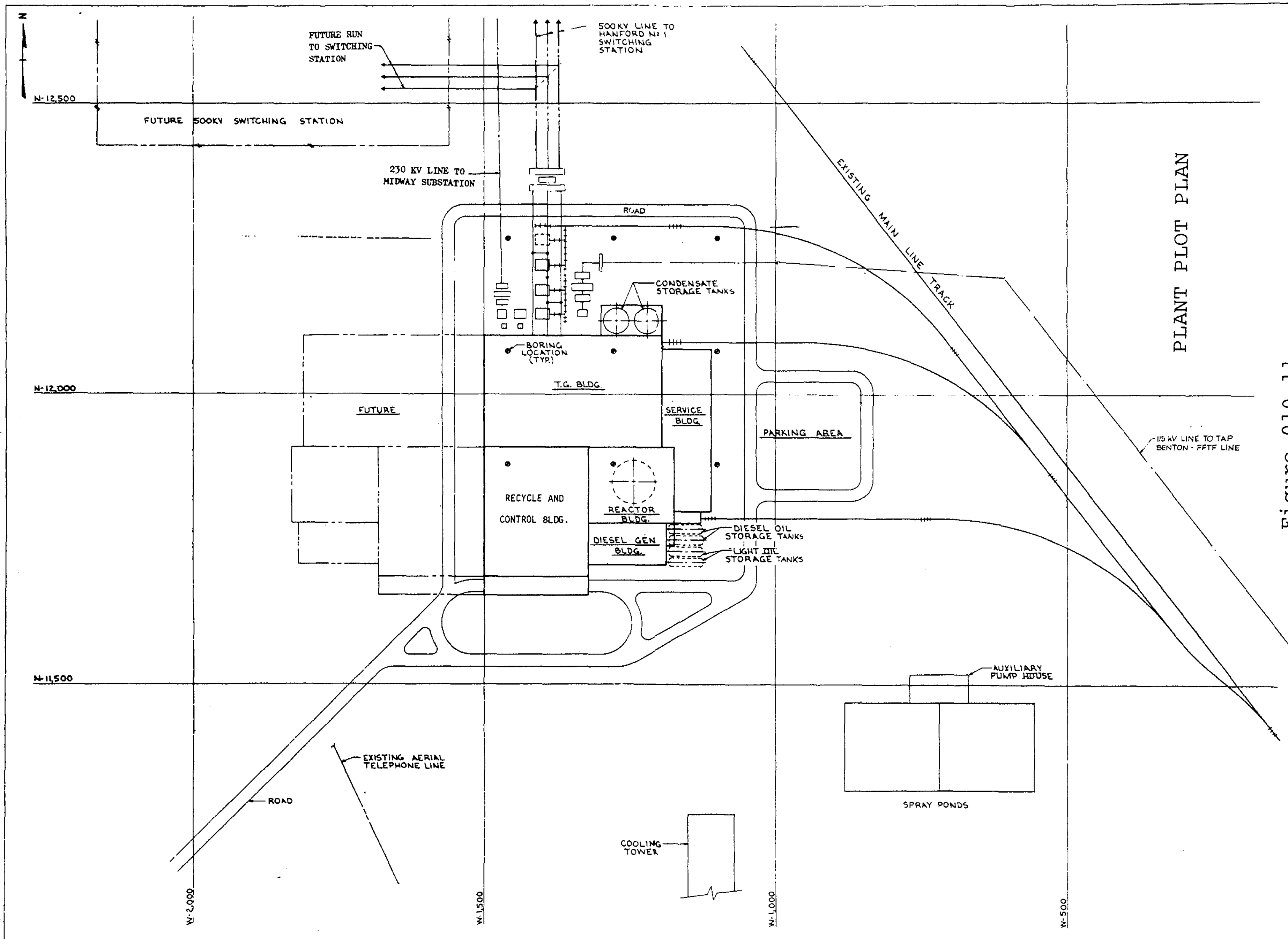


Figure 010-9



OVERALL SITE PLAN

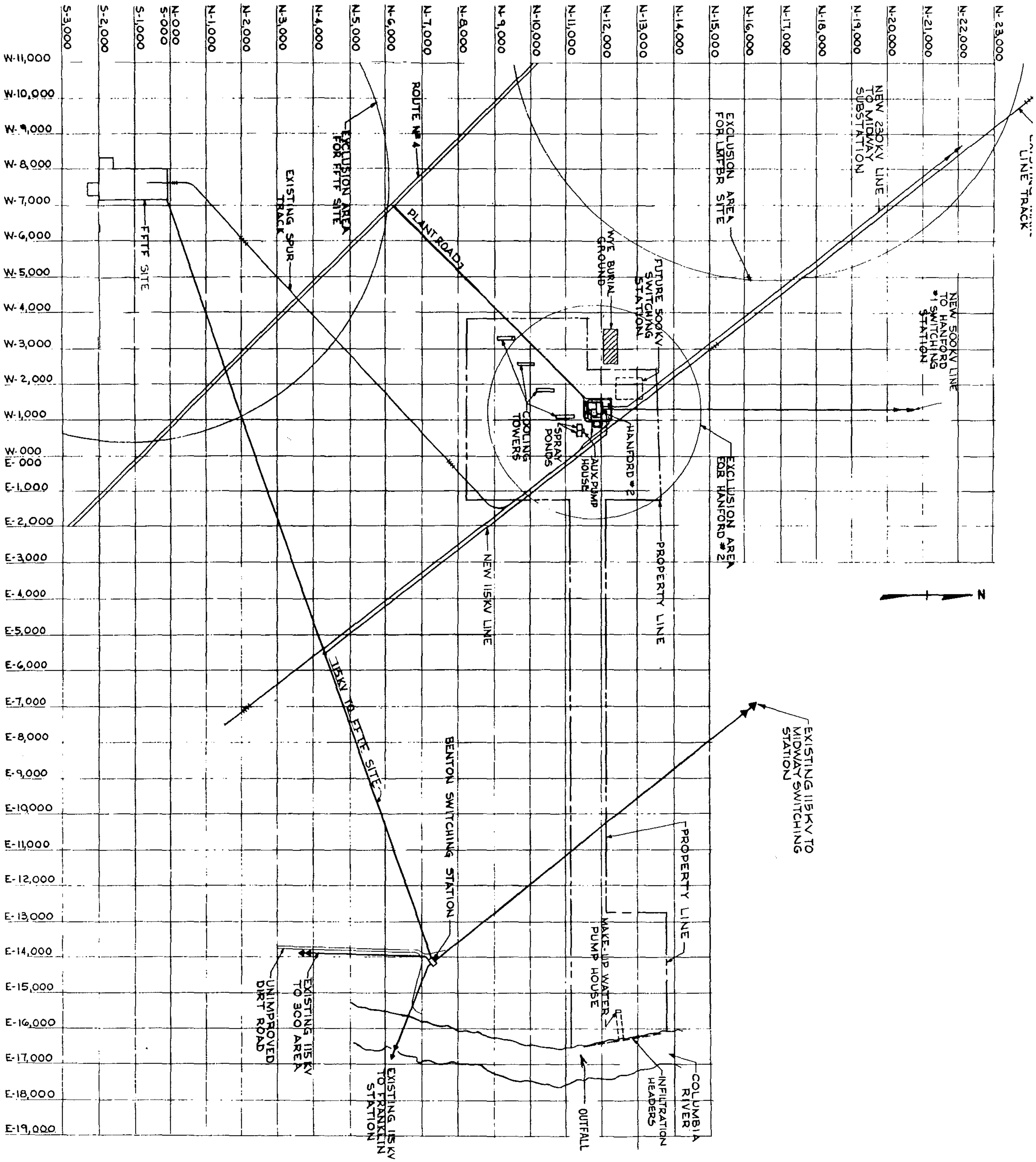
Figure 010 - 10



PLANT PLOT PLAN

Figure 010-11

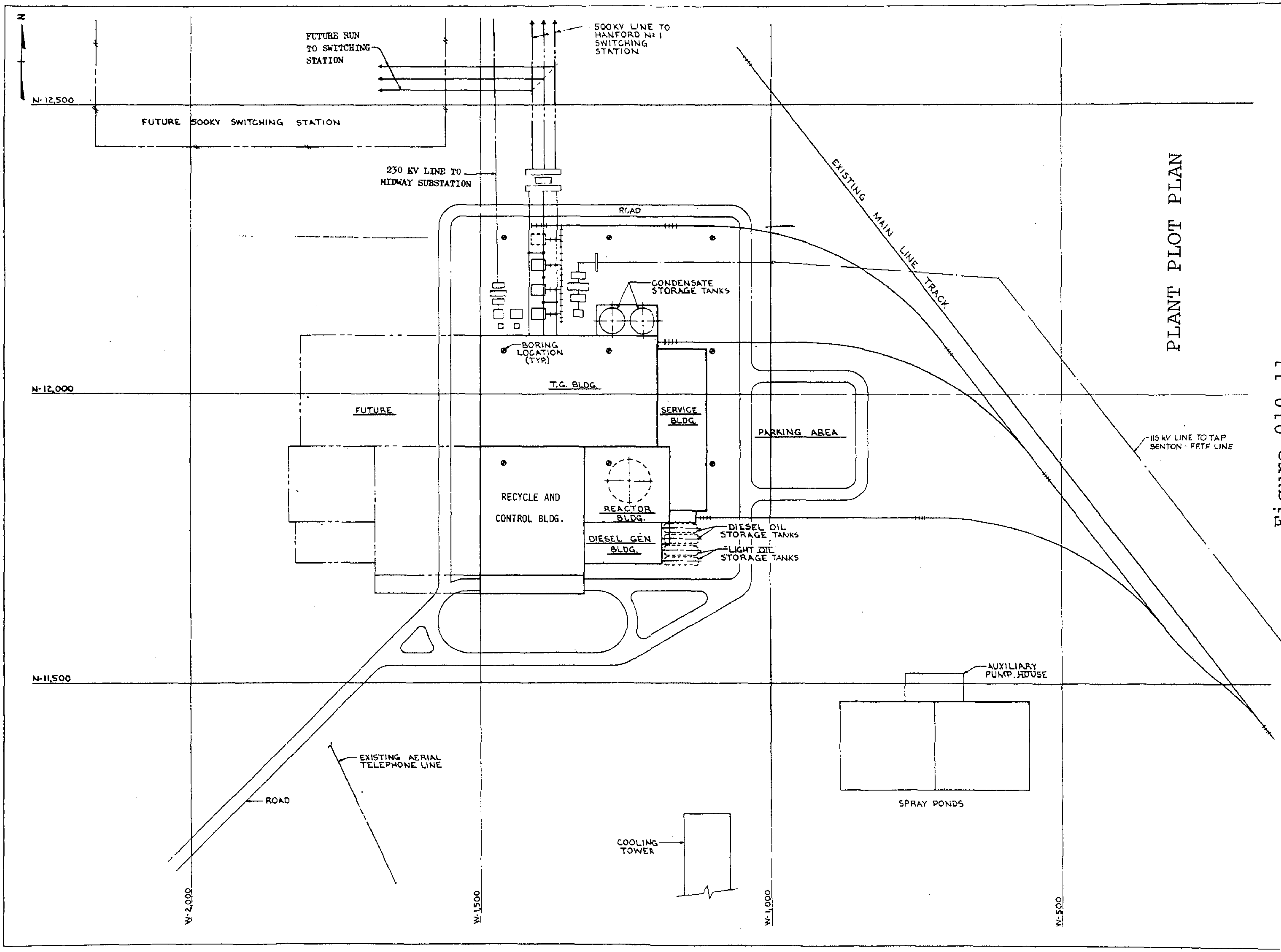
Supp. Filing 9/27/71



OVERALL SITE PLAN

Figure 010-10

Supp. Filing 9/27/71



PLANT PLOT PLAN

Figure 010-11

Supp. Filing 9/27/71

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Section 015

Health & Safety

WAC 463-12-015 - *HEALTH AND SAFETY*

(1) Supply plans covering the safe use by the public of land and water areas under its control.

The Site is within the confines of the Atomic Energy Commission's Hanford Reservation and is subject to the security system and regulations of the AEC, as well as those established by the Supply System. The use by the public of land or water areas will be subject to AEC security regulations and those established by the Supply System.

Regulations established by the Supply System for the Project are as follows:

1. Identification badges will be issued to all regularly assigned personnel of the Washington Public Power Supply System and contractor personnel.
2. Visitors from the Atomic Energy Commission and its contractors will be admitted with authorized security identifying badges.
3. All other visitors will be issued visitor identification badges by the Supply System.
4. A record will be maintained by the Supply System of all persons to whom access permits and identification badges are issued. Upon termination of visit or employment the identification badges will be returned and appropriate entry made in a badge record.
5. To prevent loss of material and/or equipment, automobiles and trucks leaving the Project and all persons carrying packages will be required to have a property pass (one-trip

or extended) authorizing removal of designated articles through the security facilities.

6. Vendor deliveries will be subject to appropriate security regulations.
7. No contraband material, i.e., cameras, liquor, fire arms, explosives, narcotics, will be allowed on the Reservation unless specifically authorized by AEC.

Supervised group tours of visitors to the Project will be encouraged during the construction and operating periods. The Supply System will provide visitation and viewing areas with restroom facilities and other conveniences during construction as well as during operation.

There will be boating and possibly commercial shipping on the Columbia River adjacent to the river shore structure. The Supply System design for such facilities shall be subject to the supervision and approval of the District Engineer, Corps of Engineers, who may temporarily suspend the work at any time, if in his judgment the interests of navigation so require.

During construction, appropriate safeguards will be taken consistent with U. S. Coast Guard and U. S. Corps of Engineers regulations to protect the public in its use of these water areas. Lights and signals on any work authorized will be provided as prescribed by the U. S. Coast Guard. If not otherwise provided by law, such lights and signals will be provided and installed at the Supply System's expense.

Intake velocity will be restricted to preclude any hazard to boaters. River structures will be designed to minimize any interference with boaters and avoid any obstruction to commercial traffic. The shoreline facilities will be provided with a fence to discourage the entrance of intruders.

The public will be protected against all structural hazards which may exist or be erected on the Project by placement of clearly marked signs or other means, visual or audio, and lighting will be used as required.

WAC 463-12-015(1) - HEALTH AND SAFETY (Supp. Filing 9/27/71)

In response to the April 14, 1971 inquiry concerning restrictions and/or limitations for public access to Hanford No. 2 Site, the AEC June 24, 1971 letter advised that "we see no insurmountable problems with respect to the use of the area for such purposes". The Supply System will be responsible for public access restrictions so as to comply with AEC and Supply System security regulations and not permit any infringement of the Hanford Reservation exclusion area.

Experience in administering Supply System and AEC public access security regulations at Hanford No. 1 has confirmed that the Applicant can assure the Council of the safe use by the public of land and water areas under its control.

The Supply System has established and maintained with the Richland office of the Atomic Energy Commission a closely coordinated program for Hanford No. 1 (and recently Hanford No. 2) programs for visitations by the public.

The Hanford No. 2 Site is located outside of the AEC traffic barricade and is isolated from the AEC production and processing facilities. Thus it is possible that public access restrictions and regulations may later be less stringent than those now implemented for Hanford No. 1.

(2) Provide a plan for compliance with health and safety requirements of the State and the Atomic Energy Commission.

Safety Zones shown in yellow on Figure 015-1 illustrate areas where access by the general public will be restricted.

The Supply System will comply with regulations established by the Atomic Energy Commission for protection against radiation hazards as set forth in 10 CFR Part 20, related to activities arising out of licenses issued by the Atomic Energy Commission.

In addition, the Supply System will comply, and require all on-site contractors to comply with all other Federal and State safety and health regulations, including, but not limited to, the regulations imposed by the Richland Office of the Atomic Energy Commission for contractors and licensees at the Hanford Reservation.

The Supply System will comply, and require all on-site contractors to comply with all applicable laws and regulations of the State of Washington concerning health and safety of the public, contractor personnel, employees and visitors.

Preliminary and final safety analysis reports are to be prepared for the Atomic Energy Commission's Division of Reactor Licensing. The preliminary report (PSAR) is anticipated to be available for submittal to the AEC in August of 1971.

Construction personnel will have available first aid from a full time nurse in attendance on the construction site. Ambulance services and all necessary equipment to handle industrial first aid treatment will be available.

The Supply System will provide all insurance deemed necessary or required by law, including nuclear property damage and nuclear liability insurance at the time required.

The Supply System will adopt internal policies in accordance with the requirements of the Atomic Energy Commission which will assure that the qualifications and training of all nuclear plant personnel will conform to AEC standards. The reactor manufacturer will, by contract, be required to provide applicable training for Project personnel. The Supply System will institute a training program, well in advance of the initial date of reactor operation, which will insure full technical training in the fueling, operation and maintenance of the Project.

In addition, the Supply System will establish a permanent Safety Review Board as required for nuclear plant licensing by AEC. The Safety Review Board will formulate safety and health regulations for the Project and will periodically review applicable health and safety programs.

Emergency plans will be developed for inclusion in the Preliminary Safety Analysis Report and more detailed plans will be included in the Final Safety Analysis Report which is required to obtain an AEC operating license. Development of these plans will be coordinated with local and state agencies, and will include detailed provisions for health and safety, prevention of property damage, emergency treatment, and special training programs.

Personal Exposure Records

The plant radiation protection engineer will be responsible for personnel monitoring and personnel exposure records. This program will be implemented by a qualified independent contractor who will provide dosimeters, analysis for exposure and compilation of radiological exposure data. A detailed program will be submitted to the AEC regarding procedures and performance to AEC exposure requirements. Copies of this information will be made available, upon request, to the Department of Social and Health Services and any other state agencies, operating in behalf of the applicant or the employees.

When requested of the applicant, the employee records will be accompanied by the following information:

Employee Name
Social Security Number
Payroll Number
Birthdate

Personnel Training and Licensing

Hanford No. 2 operating personnel will be licensed by the AEC in accordance with AEC regulations. Training of the Hanford No. 2 operating personnel will be the responsibility of the applicant and the training program curricula will be made available, upon request, to any state agency or agencies having departmental interest or regulatory authority. A copy of the training program curricula will also be made available to the Thermal Power Plant Site Evaluation Council on or before January 1, 1975.

The full time nurse in attendance at the construction site first-aid station will be licensed by the State of Washington.

Hanford No. 2 Emergency Plan

The Hanford No. 2 Emergency Plan will be a manual comprised of procedures, check lists, and necessary supporting information to establish on-site and off-site actions in response to postulated emergencies of all types. The plan will be somewhat broader than that described in the AEC rules and guides (8,9), in that it will deal not only with radiological emergencies, but other events such as civil disorder, etc. Early versions of the manual will cover the limited range of events applicable to the construction phase of the reactor, and its scope will be broadened as necessary for changing construction conditions and the approach to operating conditions.

The Plan is to provide the following:

1. Consideration of credible accidents and detailed procedures for dealing with them.
2. Detection and evaluation of emergency conditions.
3. Communication channels, internal and external, to the plant.
4. Liaison with off-site support groups, including local AEC, City, County, State and Federal authorities.
5. Establishment of protective action levels and protective measures when such levels are exceeded, i.e. actions to be taken for decontamination, first aid, and diagnosis for treatment of employees or persons

injured as a result of any incident involving radioactive contamination at the plant or other emergency.

6. Post-accident recovery and re-entry procedures.
7. Documentation, review and control of drills and training.
8. Periodic emergency preparedness assessments.

The Emergency Plan contains information that every plant employee is required to know and understand. This information pertains to non-radiological and radiological emergencies. Drills will be conducted at a frequency to ensure proper performance by personnel and adequacy of planning and preparedness.

Schedules for Emergency Planning

The final approved version of the Emergency Plan for the operating plant will be issued in time to permit plant personnel training prior to the AEC licensing exam. The schedule for the various phases of the Emergency Plan which will be required during construction and operation has been tentatively established as follows:

Item	Schedule Date	Status
Planned Approach - PSAR	8-19-71	Complete
General Outline	9-20-71	(This Report)
Detailed Outline	12-1-71	
Emergency Plan-Construction Phase (Prior to start of construction)	12-1-72	
Emergency Plan-Detailed Approach-FSAR (Submit with FSAR)	9-1-75	
Emergency Plan-Operating Phase (In time for personnel training)	4-1-76	

Plan Outline and Scope

The main sections of the Emergency Plan will be as follows:

1.0 Supply System Organization and Communications

2.0 Off-site Organizations and Communications

3.0 Spectrum of Accidents

4.0 Protective Measures

5.0 Periodic Review and Updating

6.0 Medical Support

7.0 Drills

8.0 Training

9.0 Recovery and Re-entry

10.0 Detailed Procedures

11.0 Check Lists

The format and arrangement is subject to change as the details are further developed. The anticipated content of each of these sections is given in the following expanded outlines. It should be pointed out that much of Sections 1.0 thru 9.0 are aids in preparing the Plan and for training backup. The procedures and check lists contained in Sections 10.0 and 11.0 are the heart of the Plan.

1.0 Supply System Organization and Communications

The normal operating organization and its qualifications will be described in the Emergency Plan.

The Shift Supervisor is in direct charge of the plant operation and in any given situation has the responsibility for initiating the immediate corrective action which, in his judgment, is required. He has the authority to initiate the Emergency Plan and will be responsible for proper notification of the Emergency Coordinator, the Plant Superintendent, and other properly designated individuals and/or agencies.

Incidents such as excessive personnel exposures, personnel contamination, accidental radioactivity releases, personnel injuries, fires, abnormal radiation levels, or other unusual situations of this type, are to be immediately reported to the Shift Supervisor on duty. The Shift Supervisor will, following initiation of the Emergency Plan, be responsible for establishing safe plant conditions and for directing the plant personnel in their actions to gain control of the emergency situation.

Provisions will be made to ensure that additional qualified plant staff personnel are available on an on-call basis during nights, weekends, and holidays to assist in the actions called for in the emergency procedures.

Lines of authority will be specified, and the succession of command will be clearly delineated. Minimum crew sizes and technical support for emergency conditions will be defined.

1.1 <u>Emergency Organizations</u>

Since the operating crew may be fully occupied in handling the plant conditions, emergency operations outside the plant area will be under the responsibility and control of an Emergency Coordinator. He will be responsible for communications to City, County, State and Federal agencies designated in the Plan, and for communicating with and directing technical support teams for both assistance to the plant and for evaluation of off-site effects and actions as required. (Other experienced nuclear trained personnel from nearby facilities may also be utilized if feasible.)

The qualifications of the Emergency Coordinator and the technical support team will be described in the Emergency Plan, and lines of authority will be defined in chart form. Responsibilities of key individuals in both planning and actions during emergencies will be clearly specified.

Succession of command will be clearly delineated.

1.2 Emergency Communications

Emergency communication systems will be described in the Plan and will be capable of performing under anticipated emergency conditions and adverse climatic conditions. Backup communication systems or redundancy will be provided to ensure that a single failure cannot disrupt key communications. Portable or mobile communication equipment will be provided for at least one of the communication systems. Wherever possible, existing, well-developed communications systems or channels used by the AEC Hanford Operations or contractors will be utilized. The Supply System will assume full responsibility for maintaining proper communications facilities in the event that service of the AEC or other contractors is not available.

An emergency control or command center will be established for emergency communications on-site and off-site and for direction of efforts.

2.0 Off-Site Organizations and Communications

A prime factor in the development of emergency plans for a nuclear plant is to ensure that maximum possible protection is provided for the health and safety of the public. Accordingly, agreements will be made with appropriate local, State and Federal agencies to provide supporting services. Again, wherever possible, these arrangements will coincide with those made by the Richland AEC Operations Office and State agencies so as not to complicate or confuse already established procedures. The Supply System will remain accountable for all aspects of the adequacy of the Emergency Plan for Hanford No. 2.

Agreements will clearly designate responsibilities and methods of coordination and will be reviewed and updated on a timely basis.

The types of services to be secured are listed in Table 015.2-1, while a general list of agencies which could or may be involved is shown in Table 015.2-2. (The listing is preliminary in nature, and will be either reduced or expanded as necessary during development of the Emergency Plan.)

TABLE 015.2-1

OFF-SITE SERVICES FOR EMERGENCY SITUATIONS

Transportation

Off-Site Traffic Control

Fire Protection

Medical Support

Decontamination

Communications

Technical Evaluations

Emergency Coordination Centers

Sampling and Analysis

Law Enforcement

* * * *

TABLE 015.2-2

PRELIMINARY LIST OF AGENCIES WHICH MAY BE NOTIFIED OR UTILIZED FOR PREPARATION AND COORDINATION OF HANFORD NO. 2 EMERGENCY PLAN

Nuclear Liability Insurance Companies

USAEC - Richland Operations Office

USAEC - Region V Compliance Office

U.S. Dept. of Agriculture, Defense Mobilization Planning

U.S. Forest Service

U.S. Dept. of Commerce, National Weather Service

U. S. Office of Civil Defense

U.S. Environmental Protection Agency

U.S. Dept. of Interior, Bureau of Reclamation

U.S. Dept. of Interior, Bonneville Power Administration

U.S. Coast Guard

U.S. Army Provost Marshall

TABLE 015.2-2 (Continuation)

Washington State Department of Social and Health Services

Washington State Department of Civil Defense

Washington State Patrol

Oregon State Board of Health

Oregon State Division of Emergency Services

Oregon State Police

County Sheriffs, Eastern and Central Washington

County Sheriffs, Northeastern Oregon

Local and Regional Irrigation District Offices

Hanford Environmental Health Foundation

Washington State Department of Ecology

Washington State Fire Marshall

Nearby County Civil Defense Units

Nearby City Health Departments and Hospitals

Nearby City Ambulance Services

AEC Contractors at Hanford

Supply System Participants

Local Communications Media

Red Cross

Salvation Army

3.0 Spectrum of Accidents

This section of the Emergency Plan will summarize the types of accidents covered in the procedures part of the Plan, and will lay out the criteria for action to be taken in each emergency. Reliance to be placed on instrumentation will be specified, and the types of instrumentation available will be described. The general accident spectrum to be covered includes the following:

3.1 Radiological Incidents with On-Site Effects Only

3.2 Radiological Accidents Which Could Affect the Public in Unrestricted Areas

3.3 Industrial Accidents, Including Fires

3.4 Natural Disasters

3.5 Civil Disorders

3.6 Bomb Threats

3.7 Accidents at Nearby Nuclear Reactors or Facilities Which Could Affect Hanford No. 2 Facilities or Personnel

4.0 Protective Measures

Protective measures will be defined for on-site and off-site individuals as required by the accident under consideration. These may include such measures as evacuation, taking cover, use of protective breathing apparatus, etc. In support of these measures, there shall be supplementary technical data available to ensure that the measures are implemented as required. Examples of the types of information to be available in the Emergency Plan are:

4.1 Meteorological Data

4.2 Off-site Population Distributions

4.3 Bases for Evacuation Criteria

4.4 Evacuation Routes and Reassembly Measures

4.5 Protective Equipment and Its Storage Locations, On-Site and Off-Site

5.0 Periodic Reviews and Updating

Procedures, schedules and documentation for periodic reviews and updating will be spelled out. Each involved agency will be contacted routinely to ensure their familiarity with the plans and to ensure that lists of responsible individuals, communication channels and procedures are adequate and correct.

An emergency planning committee (probably the Safety Review Board or Plant Operations Committee) will periodically review the Emergency Plan. In addition, one individual will be assigned overall responsibility for the Plan.

6.0 Medical Support

This section of the Plan will describe the prior arrangements made with physicians, hospitals, and ambulance and rescue services for contaminated, injured and exposed individuals.

The Hanford Environmental Health Foundation at Richland possesses special capabilities in the handling of radiological-medical situations, and it is expected that their service may be available. This organization operates the radio-surgery laboratory in Richland. Other medical service agencies would also be contacted for arranging necessary services.

7.0 Drills

Plant personnel are to be instructed in emergency and evacuation plans, and periodic drills will be held. Wherever possible, participation of non-Supply System groups will be included, specifically those who would be in close support such as fire protection.

Routine simulation testing of emergency conditions will be done in which the Shift Supervisor is, without prior notice, handed a sheet of paper that describes an emergency that has just occurred. The Shift Supervisor will then write out all the actions he would take to handle the emergency. Similar testing of the Emergency Coordinator and key support personnel is planned.

In addition to this type of drill, more elaborate simulations are carried out as nearly as practical like the postulated emergency. Actions which cannot be carried out are simulated. The exercise proceeds with the same timing and sequence of events and actions as a real emergency. The Shift Supervisor and Emergency Coordinator must make on-the-spot decisions and involve other people in the same way as if it were a real emergency. Following the exercise, results are critiqued by a review committee and fed back to the individual responsible for the Emergency Plan, to the individual responsible for training, and to the participants in the exercise.

8.0 Training

A training program will be initiated one year before reactor fuel loading, to familiarize all plant personnel with the Emergency Plan. Any outside service contractors will be included as necessary. Provisions for periodic retraining will be specified. The less extensive training required for the plant construction phase of the Plan will also be done prior to construction.

9.0 Recovery and Re-Entry

Recovery and re-entry measures will be developed. These measures will be based on postulated conditions and will make use of all information channels whose output would have an effect on actions or timing involved during a recovery or re-entry operation.

10.0 Detailed Procedures

This section of the Plan will be the detailed procedure for each identified emergency situation and will be used primarily as a training aid. An example of the type of procedures to be covered is as follows: (The following is not a procedure, only an indication of the type of information to be included in procedures.)

10.1 High Radiation Evacuation

10.1.1 Failure Definition

Detailed procedures will provide information sufficient to diagnose the magnitude of an emergency through use of fixed and/or portable plant radiation monitoring devices and other plant instrumentation.

10.1.2 Response to Failure - On-Site

Procedures will specify a sequence of emergency actions to be taken within the plant. For example, if it is determined from monitoring devices that radiation from or within the plant is such that permissible exposures in restricted and unrestricted areas will be exceeded if occupancy of these areas is continued, the evacuation alarm is to be sounded, the unit is to be shut down, and all personnel not essential to the emergency shutdown procedures are to immediately assemble at a safe location.

The control room is capable of continuous occupancy during all accident conditions. Protective equipment, and portable survey instruments are maintained in the control room for use by the operating personnel who remain at the plant and perform the emergency shutdown in accordance with a procedure developed specifically for this purpose. Notification of necessary authorities is initiated from the control room.

10.1.3 Response to Failure - Off-Site

Detailed procedures will specify that evacuation of the plant is to be conducted thru prescribed evacuation routes and reassembly of personnel at a relocation center. The relocation center is to be equipped with protective clothing, suitable communications, portable monitoring devices, and other emergency equipment.

The conduct of operations at the relocation center is to be under the direction of the designated WPPSS employee or his authorized alternate. Upon assembly at the relocation center, a preplanned program of increased environmental sampling and a radiation survey of the environs are to be simultaneously initiated. An estimate of the situation based on existing meteorological conditions, the results of the radiation survey, and the condition of the plant is to be made. If it is determined that evacuation of residents from a populated zone is necessary, a preplanned evacuation procedure is to be put into effect in accordance with the Emergency Plan.

10.2, 10.3, etc. (later)

Other procedures covering the spectrum of situations described previously in Section 3.0 will be provided in the Plan.

11.0 Check Lists

This section of the Plan will provide brief, key-item call and check lists for each emergency situation; and should be the only information necessary during the emergency based on adequate pre-training. Certain general emergency conditions (such as evacuation) will also be covered by handout cards for plant personnel.

(3) Provide background radiation levels of appropriate receptor media pertinent to the site.

From the beginning of activities on the Hanford Reservation, the Federal Government has conducted tests and measurements of background radiation levels. Tests have been conducted involving agricultural produce in adjacent areas, wildlife and plant life in the Reservation, Columbia River fish, and humans -- both those associated with on-site Hanford Reservation activities and those living and working away from the Reservation. The results of these tests and measurements constitute an unusually large amount of data which is available to the Supply System and the Council for review.

Among pertinent reports on the subject of background radiation levels of appropriate receptor media in the areas adjacent to the Site is Evaluation of Radiological Conditions in the Vicinity of Hanford for 1968.[1] Excerpts from this report are as follows:

External Radiation

"Ionization chambers (Victoreen stray radiation chambers) stationed on the Hanford Reservation and in Richland measure the gamma radiation exposure from external sources. Measurements in air 1 m above ground level during 1968 averaged about 0.36 mR/day or 130 mR/yr at Hanford and 0.28 mR/day or 100 mR/yr at Richland. These were not significantly different from 1966 or 1967 values. Essentially all of the exposure at Richland is from natural background and worldwide fallout from nuclear testing." *

The typical Richland resident's exposure then compares closely with the 100 mR/yr of a resident in an area considered normal,[2] at sea level, and with the external and internal dose rates as indicated in Table 015.3-1.

---

* Emphasis added

TABLE 015.3-1

(1)

DOSE RATES DUE TO EXTERNAL AND INTERNAL IRRADIATION FROM NATURAL SOURCES IN NORMAL AREAS

Source	Dose Rates (mrad/yr.)*
External irradiation	
Cosmic rays at sea level	0
Ionizing component	28
Neutrons	0.7
Terrestrial radiation	50
Cosmic rays at 20,000 feet	1500 (= 1.5 rad/yr.)
Cosmic rays near top of atmosphere	30 rad/yr.
Internal irradiation	
Potassium-40	20
Rubidium-87	0.3
Carbon-14	1
Radium-226, -228	1
Hydrogen-3 (Tritium)	2
Average total dose to body	100

*Rad is an acronym for *r*adiation *a*bsorbed *d*ose. It is the basic unit of absorbed dose of ionizing radiation. A dose of 1 rad means the absorption of 100 ergs of radiation energy per gram of absorbing material. 1 millirad = 0.001 rad. (A roentgen of gamma rays will deposit almost 1 rad in tissue.)

FISH

"Whitefish are the sports fish that usually contain the greatest concentration of radioactive materials. Furthermore they can be caught during winter months when other sports fish are difficult to sample. The average concentrations of ^{32}P in whitefish sampled downstream from the AEC reactors during 1968 was 140 pCi/g as compared with 270 pCi/g during 1967. The lower average concentration in 1968 was attributed to decreased concentration of ^{32}P in the river and decreased river temperatures."(1)

ATMOSPHERE

"Measurements of airborne ^{131}I, the radionuclide of primary interest, were made routinely during 1968 at about 30 locations within and near the Hanford Reservation. The environmental ^{131}I concentrations for 1968 averaged less than the analytical limit of 0.02 pCi/m^3 at Richland, Pasco and Kennewick."(1)

"Continuous sampling for radioactivity associated with air-borne particulates was maintained as of the end of 1968 at 35 locations, including those within the Hanford Reservation and around the plant perimeter at distances up to 75 miles. The gross beta activity of each sample filter was routinely measured (based on ^{90}Sr-Y calibration) with detailed radioanalyses performed on filters showing unusual beta activity. Average for the year was 0.2 pCi/m^3."(1)

HANFORD GROUNDWATER

"Radioactivity in the groundwater beneath Hanford Project results primarily from ground disposal of wastes in the chemical separations areas. The outer boundaries of the contamination contours, e.g., 0.1% of the AEC Concentration Guide (CG) for ^{3}H and 2% CG for ^{106}Ru-Rh, represent the detection levels routinely achievable for these radionuclides."(1)

"In all probability, some radionuclides from the chemical processing areas are presently entering the Columbia River. However, the concentrations of these nuclides are too small to be routinely measureable in the groundwater near the river or in the river itself, and any radiation dose from them is negligible."(1)

"Concentrations of ^{3}H in river water are measured upstream from Hanford at Priest Rapids and downstream from Hanford at Richland. The average concentrations of ^{3}H at Priest Rapids Dam and Richland were not significantly different at 1.6 and 1.7 nCi/liter, respectively, compared to 1.4 and 1.5 nCi/liter at these locations during 1967."(1)

Drinking water concentrations for the Tri-Cities from the above referenced report plus the maximum permissible concentrations are illustrated by Table 015.3-2.

TABLE 015.3-2

TRI-CITY DRINKING WATER

Average Concentrations[a] of Several Radionuclides in Drinking Water, 1968 (pCi/liter)

Radionuclide	Richland	Pasco	Kennewick[b]	10 CFR 20[g] MPC_W
RE + Y[c]	46	20	9	20,000
^{24}Na	1600	350	140	30,000
^{32}P	48	30	13	20,000
^{51}Cr[d]	1400	1400	480	2,000,000
^{64}Cu	350	<51	38	20,000
^{65}Zn[d]	38	35	<24	100,000
^{76}As	140	33	15	20,000
^{90}Sr[d]	<0.6	<0.5	----	300
^{122}Sb	120	100	22	30,000
^{131}I[d]	6.9	5.9	<2	300
^{133}I	41[e]	24[f]	----	1,000
^{239}Np	670	340	57	500,000
Total Beta, counts/min/ml	2.9	1.2	0.3	----

a. *Measured at the water plants*

b. *Kennewick concentrations were based on monthly grab samples collected January through June except for total beta which was based on weekly grab samples throughout the year*

c. *These radionuclides as a group are (Rare Earths + Yttrium)*

d. *Results based on cumulative samples at Richland and Pasco*

e. *Estimate based on an average ratio of* $^{133}I/^{131}I$ *of 6:1 measured in grab samples*

f. *Estimate based on an average ratio of* $^{133}I/^{131}I$ *of 4:1 measured in grab samples*

g. *Column added by the Supply System as provided in 10 CFR 20 Appendix B for Maximum Permissible Concentrations in water.*

HANFORD GROUNDWATER

"Radioactivity in the groundwater beneath Hanford Project results primarily from ground disposal of wastes in the chemical separations areas. The outer boundaries of the contamination contours, e.g., 0.1% of the AEC Concentration Guide (CG) for ^{3}H and 2% CG for ^{106}Ru-Rh, represent the detection levels routinely achievable for these radionuclides."(1)

"In all probability, some radionuclides from the chemical processing areas are presently entering the Columbia River. However, the concentrations of these nuclides are too small to be routinely measureable in the groundwater near the river or in the river itself, and any radiation dose from them is negligible."(1)

"Concentrations of ^{3}H in river water are measured upstream from Hanford at Priest Rapids and downstream from Hanford at Richland. The average concentrations of ^{3}H at Priest Rapids Dam and Richland were not significantly different at 1.6 and 1.7 nCi/liter, respectively, compared to 1.4 and 1.5 nCi/liter at these locations during 1967."(1)

Drinking water concentrations for the Tri-Cities from the above referenced report plus the maximum permissible concentrations are illustrated by Table 015.3-2.

(THIS PAGE NOT CHANGED DURING 9-27-71 SUPPLEMENTAL FILING)

TABLE 015.3-2

Radioactive Content of Tri-Cities Drinking Water (15)

Average Concentrations[a] of Several Radionuclides in Drinking Water - 1969 (pCi/liter)

Radionuclide	Richland	Pasco	10 CFR 20[g] MPC_w
RE + Y[b]	50	24	20,000
^{24}Na	1200	350	30,000
^{32}P	35	23	20,000
^{46}Sc[c]	24	37	40,000
^{51}Cr	660	600	2,000,000
^{64}Cu[c]	350	69	20,000
^{65}Zn[d]	34	30	100,000
^{76}As	99	38	20,000
^{122}Sb	56	43	30,000
^{131}I[d]	3.4	3.3	300
^{133}I	20[e]	13[f]	1,000
^{239}Np	450	250	100,000
Total Beta (counts/min/ml)	2.0	1.2	----

---

a. *Measured at the water plants*
b. *A group of 22 rare earth and 3 yttrium isotopes*
c. *January-June average*
d. *Results based on cumulative samples*
e. *Estimate based on an average ratio of* $^{133}I/^{131}I$ *of 6:1 measured in grab samples in 1969*
f. *Estimate based on an average ratio of* $^{133}I/^{131}I$ *of 4:1 measured in grab samples in 1968*
g. *Column added by the Supply System for maximum permissible concentrations in water as provided by 10CFR20 Appendix B*

Game Birds

"For the past two years, about 16 km^2 (4000 acres) of the Hanford site situated north of Ringold on the eastern side of the Columbia River has been opened to hunters during hunting season. This area which is adjacent to the river was visited in 1968 by 1537 hunters for an average of about 33 hunters on each of the 46 open days. For comparison, the average for 1967 was about 50 hunters on each of the 48 open days."(1)

"The average concentration of ^{32}P in the muscle (the edible portion) of water fowl collected at the Hanford site for the environmental monitoring program during 1968 was about 53 pCi/g for ducks and 1.4 pCi/g for geese. The maximum concentration in waterfowl during 1968 was 450 pCi/g, which is significantly lower than the maxima observed in the past few years. The maximum ^{32}P concentration in upland game bird muscle was 490 pCi/g in a quail sample."(1)

Reported concentrations of ^{32}P and ^{65}Zn isotopes in River Birds for the year 1968 are shown in Table 015.3-3.

TABLE 015.3-3

Average ^{32}P and ^{65}Zn Concentrations[a] (1) in Muscle of River Birds (pCi/g)

Species	^{32}P	^{65}Zn
Duck	53	3.3
Goose	1.4	1.5
Quail	41	3.5
Pheasant	10	4.9
Chukar	10.1	5.2

a. *Collected within 5 km (3 miles) of the Columbia River within the Hanford Boundary.*

Shellfish

"^{65}Zn and ^{32}P are the only radionuclides in the reactor effluent that are found in sufficient abundance in food organisms beyond the mouth of the Columbia River to be of radiological interest. Oysters have been found to contain higher concentrations of ^{65}Zn than other common seafoods. Monthly average concentrations of ^{65}Zn and ^{32}P are periodically measured in oysters grown commercially in the Willapa Bay area. In 1968, ^{32}P average concentrations remained at or below 1 pCi/g and from August through December as in 1967. The annual average concentrations for 1968 were 25 pCi ^{65}Zn/g and 3.3 pCi ^{32}P/g."(1)

Milk and Produce

"Monthly averages for 1968 represent data from two farms in Riverview, one of which was sampled in 1967. During 1968, the annual average ^{32}P concentration was 450 pCi/liter compared to 320 pCi/liter in 1967 as a result of inclusion of another sampling location in 1968. The 1968 annual average concentration of ^{65}Zn was 340 pCi/liter compared to 200 pCi/liter for 1967. Seasonal fluctuations in concentrations of both ^{32}P and ^{65}Zn, caused primarily by irrigation and feeding practices, followed expected trends."(1)

"During 1968, ^{131}I concentrations in both farm milk and commercial milk were generally near or below the analytical limit (3 pCi/liter). The maximum ^{131}I concentration for the period (25 pCi/liter) was measured in a single sample of farm milk collected on January 17 and was attributed to increased worldwide fallout. The average concentration for the year in farm milk was 1.5 pCi ^{131}I/liter." (1)

(4) Provide a plan for pre- and post-operational environmental radiation monitoring of appropriate receptor media in accordance with state criteria.

The Supply System will initiate a radiological monitoring program two years prior to commercial operation of the Project.

In the implementation of this program the Supply System will obtain the services of a qualified firm for radiological monitoring of the nuclear plant site. The services of the firm will include:

a) Study of existing programs and preparation of plans that will complement the existing programs.

b) Supervision and training of the Supply System personnel for sample taking.

c) Provision for laboratory testing and analyses of the samples taken at pre-established frequencies and from the pre-established media.

d) Submittal of quarterly reports for review by the Supply System.

The final program will be tailored to the Supply System's needs for environmental radiological monitoring and may be supplemented by information from the AEC contractors.

Supply System radiological monitoring will include airborne particulate sampling for alpha and beta radioactivity, together with beta and gamma background levels taken on dosimeters at the same locations. If gamma spectroanalysis indicates a need, specific nuclide analyses will be performed.

Rainwater, vegetation, soil, well water, river algae, small animal and fish samples will be taken at a frequency deemed appropriate in each case, depending upon weather, growing seasons, animal and fish activity or other considerations.

The goals of the radiological monitoring program will be the establishment of pre-operational radiation levels of natural surroundings, the determination of any effect on the environment by Project operation and to enable the Supply System to provide a record to prove compliance with regulatory, public health, and safety requirements.

Environmental Radiological Monitoring Program

Air sampling locations will be established on site and within present or future regions of high population density within a 10-mile radius of Hanford No. 2. Special attention will be given to location of air samplers within five miles from the plant. The zone from five to 10 miles of the Site is emphasized where populations are more concentrated, as illustrated by Figure 015-2, especially areas downwind of prevailing winds. The 10-mile radius zone includes parts of Franklin and Benton Counties.

In the terrestrial monitoring part of this program (vegetation, soil, farm products), the area within a 10-mile radius of Hanford No. 2 will be of primary concern. The predominant use of this area is for agriculture in the Franklin County area. The major crops are wheat, alfalfa hay, sugar beets, and potatoes. The major livestock forms are beef cattle, hogs and sheep.

Particular emphasis will be placed on the collection of those primary food-chain components which lead to man. Soil samples, native and cultivated vegetation, and dairy and poultry products (milk and eggs) will be sampled. Also sampled will be the fleshy portions (meat) of domestic animals normally consumed by man, such as chickens, beef cattle and hogs, and of wildlife such as deer and pheasants (if available).

In the aquatic program, sampling will include groundwater samples and surface-water samples from the Columbia River. The municipal water supply for the City of Richland is the Columbia

River; the intake for this supply, approximately 11 miles downstream from the Hanford No. 2 Site, will be one of the Columbia River sample stations.

The aquatic food chain constituents included in this program will be taken from the Columbia River and will include the collection of bottom sediments, bottom organisms, plankton, periphyton and fish.

Sampling frequencies will depend upon weather, growing season, animal and fish activity and other considerations deemed appropriate in each case. For example, airborne particulates will usually be collected and analyzed weekly; whereas, well waters, surface waters, bottom organisms, milk and eggs will usually be collected and analyzed quarterly. Most vegetation and soil samples will be collected and analyzed annually.

Radiochemical analyses will be performed using analytical procedures equal to or better than those recommended by the U. S. Public Health Service.[3]

In addition to the required environmental monitoring, emission monitoring and data reporting, the Supply System will furnish reasonable access to the Hanford No. 2 Site and project data for the purpose of evaluating effectiveness of the environmental monitoring program.

Various aspects of the program, including sample types, sample stations, sample frequency and types of analysis, are described below and are summarized in Table 015(4) - 1.

TABLE 015(4) - 1

SAMPLING SUMMARY

Sample Type	Stations	Sampling Frequency	Analysis
1. Background			
a) Gamma Sensitive Detector	3	Continuous Recording)	(Background Gamma
b) TLD Dosimeters	10	Monthly - Annually)	(Readout and Record (at Noted Frequency
2. Airborne Particulates	10	Weekly)	(Gross Alpha (Gross Beta (Gamma Scan
3. Cooling Water	1	Continuously)	(Gamma Activity
	1	Weekly)	(Suspended Gross Alpha (Gross Beta (Dissolved Gross Alpha (Gross Beta (Gamma Scan
4. River Water	5	Quarterly)	(Suspended Gross Alpha (Gross Beta (Dissolved Gross Alpha (Gross Beta (Gamma Scan
5. Ground Water and	6	Annually)	(Gross Alpha (Gross Beta (Gamma Scan
Rain Water	3	Monthly)	
6. Vegetation & Livestock			
a) Natural Vegetation	10	Annually (During Growing Season))	(Gross Beta (^{90}Sr (^{137}Cs (^{131}I (Gamma Scan
b) Food & Feed Crops	10	"	
c) Food Animals	5	"	
7. Soil	5	Annually)	(Gross Alpha (Gross Beta (^{90}Sr (^{137}Cs (Gamma Scan
8. Sediment	5	Annually)	(Gross Alpha (Gross Beta (^{90}Sr (Gamma Scan
9. Milk	3	Quarterly)	(^{131}I (^{90}Sr (^{137}Cs (Elemental Calcium
10. Aquatic Biota			
a) Aquatic Life	3	Annually)	(Gross Beta (^{40}K (^{90}Sr (Gamma Scan
b) Rooted Aquatic Plants and Slime	3	Annually)	
11. Wildlife			
a) Rabbits	5	Annually)	(Thyroid - ^{131}I (Femur - ^{90}Sr (Gamma Scan (Muscle - ^{32}P, ^{65}Zr
b) Waterfowl	5	Annually)	

Sample stations are described in the following discussion of sample types and are located approximately in Figure 015-3.

1. Atmosphere

   a. Gamma Detectors: (△ in Figure 015-3).

      The atmosphere is continuously monitored for gamma radiation using a gamma strip chart recorder. These stations are at three positions on the site boundary.

   b. TLD Dosimeters: (△,○ in Figure 015-3).

      Background levels of external radiation are established by exposing thermoluminescent dosimeters (TLD) for various period of time at 10 locations within a 10 mile radius of the Site. Two dosimeters are maintained at each station. One dosimeter is changed and read monthly. The other dosimeter is changed and read annually. The dosimeters will be located at each air sampling station.

2. Airborne Particulates: (△,○)

   Airborne particulates are collected on a weekly basis at 10 sampling stations. The filters will be changed weekly. The filter housings are located 6-8 feet above ground level to reduce dust loading of the filters and minimize the influence on sample activity of radon and its daughters emitting from the soil.

3. Cooling Water:

   Cooling water blowdown will be monitored continuously for gamma activity. A weekly sample will be taken for more detailed analysis and for calibration of the continuous gamma monitor.

4. River Water: (⬡ in Figure 015-3).

   Sampling of the Columbia River is performed on a quarterly basis from five locations extending from about 5 miles above the plant intake to 15 miles below the station.

5. Groundwater and Rainwater

   a. Groundwater: (⊙ in Figure 015-3).

      Sampling of groundwater is performed annually from wells near the station. The wells are identified by the following numbers: 15-15, 27-8, 24-E, 20-E12, 10-E12, and S6-E-14.

b. Rainwater: (Δ in Figure 015-3).

Sampling of rainwater is performed monthly or as possible at these locations. These stations are located on the Site boundaries, and are common to the continuous gamma monitors and recorders as well as air samplers.

6. Vegetation and Livestock Sampling

a. Natural Vegetation at Air Sampling Stations

Samples of the leafy portions of natural vegetation available at each of ten air sampling stations are collected annually (in the latter portion of the growing season).

b. Food and Feed Crops

Edible portions of food and feed crops are sampled at 10 locations within a 10 mile radius of the station. Four of the air sampling locations will be used along with the milk station. Three other samples will be collected at random within the 10 mile radius. These samples should be collected annually (in the latter portion of the growing season).

c. Food Animal Samples

Food animal samples will be collected near five air sampling stations. These food samples need only be a small portion of a large animal and can be obtained from farmers and ranchers as incidental to their personal or commercial butchering.

7. Soil

Soil samples are collected annually at the air sampling locations 4, 5, 9, 10, and milk station M-2.

8. Sediment Samples

Samples of the Columbia River bottom sediment are collected annually at or near the five Columbia River water collection stations, and at other such plant locations as may be required by plant design.

9. Milk Samples (M-1, M-2, M-3 in Figure 015-3)

Milk is sampled quarterly from the bulk cooling tanks of three milk producers within 10 miles of the plant. In the selection of milk sample locations, an attempt will be made to select established milk producers who are likely to remain in the business of milk production during succeeding years of plant operation.

10. Aquatic Biota

a. Animals

Aquatic animals are collected annually from the Columbia River at three locations, river water sampling stations (⬡) 1, 2, and 5 and at such plant effluent locations as may be required by plant design.

b. Vegetation

Rooted aquatic plants and slime growths on submerged surfaces in littoral locations will be collected annually.

11. Wildlife

a. Five rabbits will be collected annually from land adjacent to the Site. An effort will be made to take these animals from different locations.

b. Five waterfowl will be collected annually near the Site. It is desirable to obtain resident birds, so the collection should be made when migrations are not underway.

Release of Radionuclides

Radioactive material within nuclear plants consists of fission products and activation products. The amount of fission product activity outside the fuel depends upon the integrity of the fuel cladding.

The plant is being designed to accommodate a maximum annual average fuel leak rate of 100,000 μCi/sec of a diffusion mixture of noble gases referenced to 30-minute decay. This fuel leak rate is referred to as the "design basis", although it is expected that fuel leak rates will normally be only a small fraction of the design basis. If fuel leak rates greater than the design basis are encountered it may be necessary to remove some defective fuel prematurely in order to keep releases of radioactivity as low as practicable.

Estimates of the quantity of radionuclides expected to be released from Hanford No. 2 are derived primarily from experience with the following boiling water nuclear power plants:

Dresden No. 2, operated by Commonwealth Edison Co. in Illinois.

Kernkraftwerk RWE-Bayernwerk GM.B.H.(KRB), operated by RWE-Bayernwerk, Gundremmingen, West Germany.

Table 015(4)-2 shows expected maximum annual average amounts of biologically significant radionuclides which may be present in liquid effluents discharged to the environment. Amounts listed are calculated assuming a fuel leak rate at the design basis are not necessarily all measurable in the effluent waste or in the environment.

The adsorption of noble gases on charcoal depends upon gas flow rate, hold-up time, mass of charcoal and a gas-unique coefficient known as the dynamic adsorption coefficient. The parametric interrelationships and governing equations are well proven from three years of operation of a similar unit at the KRB Reactor operating at 77°F, and data for operation at 0°F, as planned for Hanford No. 2, can be reliably derived. Table 015(4)-3 shows the estimated release rates of various isotopes of krypton and xenon from Hanford No. 2 with the fuel leak rate at the plant design basis. For comparison purposes, the release rate which would have been expected from the charcoal adsorbers without refrigeration is included.

Potential Pathways of Exposure to Man

Radiation doses discussed in this subsection are based upon release rates of radionuclides in liquid and gaseous effluents presented in Tables 015(4)-2 and 015(4)-3. Release rates of tritium from the plant are expected to reach 20 curies per year. Most of this is expected to be released to the liquid effluent, and for environmental dose estimates it was assumed that 80 percent (16 curies per year) would be discharged with liquids and 20 percent (4 curies per year) would be discharged to the atmosphere.

Liquid Effluents

Liquid effluents from Hanford No. 2 may be discharged to the Columbia River occasionally with the blowdown water from the cooling tower system. Table 015(4)-2 shows not only the expected release rates of radionuclides but also the resulting concentration in the river as a result of operation of Hanford

No. 2. In addition to the tabular values shown in Table 015(4), a release rate of 16 Ci/yr of tritium is associated with an annual tritium concentration of 0.16 pCi/l.

Radiation doses to people utilizing the Columbia River for fishing, swimming, and drinking water are infinitesimal from such low concentrations. For example, the whole-body dose to a person eating 20 kg/yr of Columbia River fish, fishing on the bank 500 hrs/yr, swimming in the river 100 hrs/yr and drinking 730 l/yr of water containing such concentrations is estimated to be approximately 10^{-4} mrem/yr. This whole body dose results primarily from radiocobalt and radiocesium. These low doses are far below the guide of the 5 mrem/yr proposed in 10CFR50, Appendix I and the 100 mR/yr normally received by the average individual at sea level.

A further comparison can be made with the tritium currently in the Columbia River as a result of fallout. During 1970, the average tritium concentration measured in the Columbia River a short distance below Priest Rapids Dam was 800 pCi/liter, a value 5,000 times greater than that estimated to be contributed from the operation of the plant.

Gaseous Effluents

The release rates of noble gases given in Table 015(4)-3 for charcoal adsorbers at 77°F were used by the reactor vendor in a computer program to calculate annual external dose at various points of the compass around the discharge point ranging from the Site boundary on out to 50 miles. In addition, integrated population dose (man-rem) were calculated for the population expected in the year 2015. Hanford meteorological

TABLE 014(4)-2

Estimate Annual Radioactivity Release In Liquid Effluents Excluding Tritium*

Isotope[(a)]	Half-Life	Release Rates[(b)] (Ci/yr)	Environmental[(c)] Inventory at 10 Years (Ci)	Estimated Average Concentration in Columbia River (pCi/l)***
Sr-89**	50.6 d	3.7×10^{-3}	7×10^{-4}	3.7×10^{-5}
Sr-90**	28 yr	1.0×10^{-3}	9×10^{-3}	1.0×10^{-5}
Sr-91**	9.7 hr	4.6×10^{-2}	7×10^{-5}	4.6×10^{-4}
Mo-99**	66 hr	9.9×10^{-2}	1×10^{-3}	9.9×10^{-4}
I-131	8.05 d	4.6×10^{-2}	2×10^{-3}	4.6×10^{-4}
I-133	20.8 hr	7.7×10^{-2}	3×10^{-4}	7.7×10^{-4}
I-135	6.7 hr	3.5×10^{-2}	4×10^{-5}	3.5×10^{-4}
Cs-134	2.1 yr	5.0×10^{-4}	1×10^{-3}	5.0×10^{-6}
Cs-137	30 yr	1.0×10^{-3}	9×10^{-3}	1.0×10^{-5}
Ba-140**	12.8 d	9.9×10^{-2}	5×10^{-3}	9.9×10^{-4}
Ce-144**	284 d	1.3×10^{-4}	2×10^{-4}	1.3×10^{-6}
Np-239	2.35 d	1.0×10^{-1}	9×10^{-4}	1.0×10^{-3}
Co-58	70 d	5.4×10^{-3}	2×10^{-3}	5.4×10^{-5}
Co-60	5 yr	5.4×10^{-4}	3×10^{-3}	5.4×10^{-6}
	Totals	~.5 Ci/yr	~0.03 Ci	0.005 pCi/l

* Tritium releases from the plant are expected to be less than 20 Ci/yr. The distribution between gaseous and liquid wastes will depend on the actual amount of water leaving by each route.

a. Isotopes having a half-life less than 2.3 hours were excluded because the holdup in the plant generally would be sufficient to result in negligible concentrations in released wastes. Other isotopes of the elements listed were considered. The radionuclides Zr-95, Nb-95m Ru-103, Ru-106, Te-129m, Te-132, Nd-147, Na-24, S-35, P-32, Cr-51, Mn-54, Mn-56, Fe-55, Fe-59, Cu-64, Ni-65, Zn-65m Zn-69m, Ag-110m, Ta-182, and W-187 also were considered, but omitted. These radionuclides may be present, but if present will be negligible relative to those isotopes listed.

b. Although two significant numbers are used to express release rates as a convenience for making further calculations, only one significant figure is warranted by source data.

c. Quantity present in the environment at the end of 10 years as a result of continuous discharge at release rate shown.

** Daughter isotopes of yttrium, technetium, lanthanum, and praseodymium may be observed in waste samples in equilibrium with, their parent depending on sample and analysis timing and procedure.

*** Based on an annual average Columbia River flow rate of 1×10^{14} l/yr. Bases also include no holdup or removal of radionuclides in discharge line and complete mixing of liquid effluent with river water.

TABLE 015(4)-3

Estimated Radioactivity Release Rates*
In Gaseous Effluents Excluding Tritium

Release Rates μCi/sec

Isotope	Discharge from 30 Min. Hold-up Line	Discharge from 77 F Charcoal Adsorbers (16 bed)	Discharge from 0 F Charcoal Adsorbers (16 bed)
Kr-83m	2,850	0.18	--
Kr-85m	5,050	85	--
Kr-85	8.0	8.0	8.0
Kr-87	14,800	0.011	--
Kr-88	16,200	27	--
Kr-89	264	0	--
Xe-131m	11	3.7	--
Xe-133m	200	0.56	--
Xe-133	5,210	400	--
Xe-135m	8,070	0	--
Xe-135	17,700	0	--
Xe-137	1,010	0	--
Xe-138	28,700	0	--
Halides	0	0	--
Total	~ 100,000	530	8.0

*Based on diffusion mixture

Note: A continuous release rate of 8.0 microcuries of krypton-85 per second corresponds to a release of 250 curies of Krypton-85 per year.

data, and standard calculation methods were employed.

The results of these calculations indicated that with charcoal adsorbers operating at 77°F the maximum dose at a point 300 feet away would be 1.7 mrem/yr in a SE direction; and that the integrated population dose within a 50-mile radius of the plant would be only 4.2 man-rem/yr from the plant compared to an integrated dose from natural background radiation of 85,100 man-rem/yr. For charcoal adsorbers operating at 0°F the exposures will be substantially less. Because no halides are expected to be released to the atmosphere, no radiation doses from land food chain pathways will be incurred. The inhalation dose from the estimated release of 4 Ci/yr of tritium to the atmosphere would be on the order of 10^{-4} mrem/yr to the whole body at the point of maximum annual average air concentration on the site boundary.

The quantity of radionuclides released to the Columbia River with the blowdown water from Hanford No. 2 will be less than 1% of the U. S. Atomic Energy Commission's limits for liquid effluents as set forth in Part 20 (Standards for Protection Against Radiation), Title 10 of the Code of Federal Regulations (CFR).

The kinds and concentrations of radionuclides which may be present in the Columbia River as a result of operation of Hanford No. 2 are given in Table 015(4)-2. An assessment of the possible radiation effects to the river biota can be gained by comparing the concentrations of these nuclides with those that were formerly introduced to the river by the plutonium production reactor effluents. The annual average concentration of reactor effluent radionuclides in Columbia River water at Richland was greater than 6000 pCi/l during 1968-69[4]; the average annual contribution from the liquid wastes from Hanford No. 2 will be approximately 0.2 pCi/l when mixed with the Columbia River flow. As mentioned previously, the plutonium production reactor effluents have not had a perceptible radiation effect on the river biota.

The biological effects of the Hanford production reactors have been studied for more than 20 years by raising salmonids in different concentrations of reactor effluent[5]. Exposure of chinook salmon from the fertilized egg to the seaward migrating juvenile stage produced no significant lethality in six percent reactor effluent, a concentration many fold greater than found in the Columbia River downstream from the effluent outfalls for the production reactors, and very much higher than can be anticipated in the cooling tower blowdown from Hanford No. 2.

Dose rates of approximately 23 milliroentgens per day (8.3 R/yr) have been measured in resident species of river fish in the Hanford reach during 1968 when three production reactors were operating[6]. Dose rates of 0.5 to 5 R/day for 80-100 days of the embryonic development of chinook salmon had no significant effect on the mortality or growth of the juvenile stages[7]. These fish were released and allowed to migrate normally to the ocean. No decrease in survival or fecundity was found when they returned to freshwater as spawning adults.

These and other studies of radiation on aquatic organisms would indicate that the radiation resulting from Hanford No. 2 would have an imperceptible effect on the Columbia River biota.

Tritium Significance

Tritium will exist as a gas or combined in water. In the presence of water the majority of the tritium will remain with the water and not appear as a gas. The expected tritium release rate in the plant off-gases results in concentrations well below the 10CFR20 limits. Expected concentration of tritium in the reactor water at a formation rate of 0.30 μCi/sec is based on experience from other BWR's.

Sampling and analysis of excess inventory water prior to release will include tritium analysis and will assure that the concentration in the outfall line is within release criteria.

Tritium formation and releases will be followed independent of the other isotopes because of the unique analytical methods required and its presence in the environmental surface waters. The release rate of tritium will be based on the limit in 10CFR20 (and the proposed guidelines of 10CFR50 Appendix I) regardless of the criteria for the remainder of the isotopes. The release rate for the remainder of the isotopes may be based on the "gross unidentified" limits or the limits for identified isotopes. Operating experience at other BWR plants indicate that the concentration of tritium in the waste stream will not be the limiting isotope on which to base the dilution.

The dose rate to the environs due to tritium is negligible and therefore is not considered significant in the radioactive waste systems.

The Hanford No. 2 Environmental Monitoring Program has been amended from the description contained in the August 20, 1971 supplemental filing Section 015(4), pages 3 through 8. The amended monitoring program is contained on pages 17 through 24.

Environmental Radiological Monitoring Program (revised)

Air sampling locations will be established on site and within present or future regions of high population density within a 10-mile radius of Hanford No. 2. Special attention will be given to location of air samplers within five miles from the plant. The zone from five to 10 miles of the Site is emphasized where populations are more concentrated, as illustrated by Figure 015-2, especially areas downwind of prevailing winds. The 10-mile radius zone includes parts of Franklin and Benton Counties.

In the terrestrial monitoring part of this program (vegetation, soil, farm products), the area within a 10-mile radius of Hanford No. 2 will be of primary concern. The predominant use of this area is for agriculture in the Franklin County area. The major crops are wheat, alfalfa hay, sugar beets, and potatoes. The major livestock forms are beef cattle, hogs and sheep.

Particular emphasis will be placed on the collection of those primary food-chain components which lead to man. Soil samples, native and cultivated vegetation, and dairy and poultry products (milk and eggs) will be sampled. Also sampled will be domestic animals normally consumed by man, such as chickens, beef cattle, and hogs, and of wildlife such as deer and pheasants (if available).

In the aquatic program, sampling will include groundwater samples and surface-water samples from the Columbia River. The municipal water supply for the City of Richland is the Columbia River; the intake for this supply, approximately 11 miles downstream from the Hanford No. 2 Site, will be one of the Columbia River sample stations.

The aquatic food chain constituents included in this program will be taken from the Columbia River and will include the collection of bottom sediments, bottom organisms, plankton, periphyton and fish.

Sampling frequencies will depend upon weather, growing season, animal and fish activity and other considerations deemed appropriate in each case.

Radiochemical analyses will be performed using analytical procedures equal to or better than those recommended by the U.S. Public Health Service.[3]

The radiological monitoring program outlined in Table 015(4)-1 (revised October 12, 1971) represents the level of surveillance during the preoperational phase (two years) and one year postoperational phase. If the average rate of radioactive discharge during operation is well below that which would result in a detectable level in the environment, an intensive monitoring program serves no practical purpose. It is the Applicant's plan to scale the surveillance program based upon the gradient concept with the degree of off-site monitoring commensurate with the level of radioactive discharges. In 1971 it is premature to attempt to establish reference activity levels for the gradient concept other than to indicate it represents the Supply System's planned approach. Details of the surveillance gradients will be documented and submitted to the AEC as part of the licensing process and will be made available to the Council or an agency designated by the Council.

TABLE 015(4) - 1 (Revised)

SAMPLING SUMMARY

Sample Type	Stations	Sampling Frequency	Analysis
1. Background			
a) Gamma Sensitive Detector	3	Continuous Recording)	(Background Gamma
b) TLD Dosimeters	10	Monthly - Annually)	(Readout and Record (at Noted Frequency
2. Air (Particulates & Gas)	10	Weekly)	(Gross Alpha (Gross Beta (Gamma Scan + Radioiodine
3. Cooling Water (After Plant Startup)	1	Continuously)	(Gamma Activity
	1	Weekly)	(Suspended Gross Alpha (Gross Beta (Dissolved Gross Alpha (Gross Beta (Gamma Scan + Tritium
4. River Water	5	Quarterly)	(Suspended Gross Alpha (Gross Beta (Dissolved Gross Alpha (Gross Beta (Gamma Scan + Tritium
5. Ground Water and	6	Semiannually)	(Gross Alpha (Gross Beta
Rain Water (As Available)	3	Monthly)	(Gamma Scan + Tritium
6. Vegetation & Livestock			
a) Natural Vegetation	10	3 Samples Annually (During Growing) Season))	(Gross Beta (^{90}Sr
b) Food & Feed Crops	10	")	(^{137}Cs (^{131}I
c) Food Animals	5	")	(Gamma Scan
7. Soil	5	Quarterly)	(Gross Alpha (Gross Beta (^{90}Sr (^{137}Cs (Gamma Scan
8. Sediment	5	Quarterly)	(Gross Alpha (Gross Beta (^{90}Sr (Gamma Scan
9. Milk	3	Monthly)	(^{131}I (^{90}Sr (^{137}Cs (Elemental Calcium
10. Aquatic Biota			
a) Aquatic Life	3	Semiannually)	(Gross Beta (^{40}K
b) Rooted Aquatic Plants and Slime	3	Semiannually)	(^{90}Sr (Gamma Scan
11. Wildlife			
a) Rabbits	5	Annually)	(Thyroid - ^{131}I (Femur - ^{90}Sr
b) Waterfowl	5	Annually)	(Gamma Scan (Muscle - ^{32}P, ^{65}Zr

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Sample stations are described in the following discussion of sample types and are located approximately in Figure 015-3.

1. Atomosphere

   a. Gamma Detectors: (△ in Figure 015-3).

      The atmosphere is continuously monitored for gamma radiation using a gamma strip chart recorder. These stations are at three positions on the site boundary.

   b. TLD Dosimeters: (△ , ○ in Figure 015-3).

      Background levels of external radiation are established by exposing thermoluminescent dosimeters (TLD) for various periods of time at 10 locations within a 10 mile radius of the Site. Four dosimeters are maintained at each station. One dosimeter is changed and read monthly. The other dosimeters are changed and read annually. The dosimeters will be located at each air sampling station.

2. Airborne Pariculates: (△ , ○)

   Airborne particulates are collected on a weekly basis at 10 sampling stations. The filters will be changed weekly. The filter housings are located 6-8 feet above ground level to reduce dust loading of the filters and minimize the influence on sample activity of radon and its daughters emanating from the soil.

3. Cooling Water:

   Cooling water blowdown will be monitored continuously for gamma activity. A weekly sample will be taken for more detailed analysis and for calibration of the continuous gamma monitor.

4. River Water: (○ in Figure 015-3).

   Sampling of the Columbia River is performed on a quarterly basis from five locations extending from about 5 miles above the plant intake to 15 miles below the station.

5. Groundwater and Rainwater

   a. Groundwater: (• in Figure 015-3).

Sampling of groundwater is performed semiannually from wells near the station. The wells are identified by the following numbers: 15-15, 27-8, 24-E, 20-E12, 10-E12, and S6-E-14.

b. Rainwater: (Δ in Figure 015-3).

Sampling of rainwater is performed monthly or as possible at these locations. These stations are located on the Site boundaries, and are common to the continuous gamma monitors and recorders as well as air samplers.

6. Vegetation and Livestock Sampling

a. Natural Vegetation at Air Sampling Stations

Samples of the leafy portions of natural vegetation available at each of ten air sampling stations are collected annually. Samples will be taken throughout the growing season with the predominate vegetation at the station being the sample collected.

b. Food and Feed Crops

Edible portions of food and feed crops are sampled at 10 locations within a 10 mile radius of the station. Four of the air sampling locations will be used along with the milk stations. Three other samples will be collected at random within the 10 mile radius. These samples should be collected throughout the growing season.

c. Food Animal Samples

Food animal samples will be collected near five air sampling stations. These food samples need only be a small portion of a large animal and can be obtained from farmers and ranchers as incidental to their personal or commercial butchering.

7. Soil

Soil samples are collected quarterly at the air sampling locations 4, 5, 9, 10, and milk station M-2.

8. Sediment Samples

Samples of the Columbia River bottom sediment are collected quarterly at or near the five Columbia River water collection stations, and at other such plant locations as may be required by plant design.

9. Milk Samples (M-1, M-2, M-3 in Figure 015-3).

Milk is sampled monthly from the bulk cooling tanks of three milk producers within 10 miles of the plant. In the selection of milk sample locations, an attempt will be made to select established milk producers who are likely to remain in the business of milk production during succeeding years of plant operation. Information regarding source of feed must be included with milk sample results.

10. Aquatic Biota

a. Animals

Aquatic animals are collected semiannually from the Columbia River at three locations, river water sampling stations (⬡) 1, 2, and 5 and at such plant effluent locations as may be required by plant design.

b. Vegetation

Rooted aquatic plants and slime growths on submerged surfaces in littoral locations will be collected semiannually.

11. Wildlife

a. Five rabbits will be collected annually from land adjacent to the Site. An effort will be made to take these animals from different locations.

b. Five waterfowl will be collected annually near the Site. It is desirable to obtain resident birds, so the collection should be made when migrations are not underway.

Reports

At the end of each six-month period (January 1, July 1) a routine operating report will be submitted. The reports are due within 60 days after the end of each reporting period. The following information pertinent to the radiological monitoring program will be provided and summarized on a monthly basis:

1. Activity Discharged with Liquids

    Total curie activity discharged.

    Total volume (in gallons) of liquid waste discharged.

    Total volume (in gallons) of dilution water used.

    Average concentration (in uc/mil) at outfall of discharge pipe.

    Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).

    Percentage of annual limit released.

    Results of isotopic analysis.

    Total curie activity of tritium discharged.

2. Activity Discharged with Gases

    Total curie activity discharged separated into noble gases, iodine, and particulates.

    Time and date of the maximum activity released (for any consecutive 24 hours during the reporting period).

    Percentage of each maximum annual limit released.

    Results of isotopic analysis.

    Total curie activity of tritium discharged.

3. Radiological Environmental Monitoring

    A narrative summary including correlation with effluent releases of the results of off-site environmental surveys performed during the report period.

    Tabulation of the results of the environmental monitoring program.

    For any sample which indicates statistically significant levels of radioactivity above established background levels a comparison with applicable 10CFR20 limits shall be provided.

Meteorological Data

In addition to the vast accumulation of meteorological data available for the Hanford Reservation, the Supply System will install a meteorological tower to establish meteorological characteristics of the Hanford No. 2 Site over a period of at least two years prior to startup. Detailed measurements of wind speed, direction, low level stability and humidity will be gathered. These data will be reported annually in summary form. Following this intensive two-year data collection period the Supply System plans to maintain wind speed and direction instrumentation but no detailed evaluation of the data will be made.

Unusual Operating Conditions

Any unusual occurances resulting in, or expected to result in, releases of radioactivity in excess of regulatory limits will be reported by telephone to the Radiation Control Section, Health Services Division as soon as practical.

The environmental monitoring program established by the Supply System will have as its objective the determination of the effects of the power project operation on the environment, the ecology of the land and its wildlife, and the adjacent waters and their aquatic life. The program will provide an environmental measurement history for evaluation by the appropriate state agencies. Such a program will use reasonable and available methods and be maintained throughout the life of the Project.

THE FOLLOWING IS A PARTIAL LIST OF ACTIONS TO BE ADOPTED BY THE SUPPLY SYSTEM TO IMPLEMENT THE HANFORD NO. 2 ENVIRONMENTAL MONITORING PROGRAM AS REQUIRED BY GUIDELINE 015(4); 035(1b); AND, 035(2b):

1. The Hanford No. 2 environmental and radiological monitoring program will be flexible and will be modified as detailed information is acquired incorporating the following: (a) plant emissions as compared to outside conditions prior to and during Project operation, (b) informational inputs obtained during the preoperational monitoring, (c) siting by others of nuclear or non-nuclear facilities in areas surrounding the plant site, and (d) technological developments in the field of environmental monitoring.

2. The Supply System will identify the environmental monitoring consultant and advise the Thermal Power Plant Site Evaluation Council.

3. The preliminary sampling schedules have been submitted to the Council and any changes will be transmitted to the Council for review.

4. The Supply System agrees that it will upon request provide environmental monitoring records and information, to the Council or any agency designated by the Council.

5. The Supply System will continue to coordinate its environmental monitoring program with monitoring programs of other operators of nuclear facilities in the area.

6. The Supply System will coordinate its environmental monitoring program with local, state and federal agencies maintaining monitoring programs in the area.

7. The Supply System agrees that the monitoring program may require revision at a future date, and that such modification will be discussed with the Council, or any agency designated by the Council, unless required by AEC, in which case the changes will be transmitted to the Council.

8. The Supply System agrees that it will furnish the appropriate state agencies, upon request, half-samples of specimens for their evaluation and analysis.

9. A copy of the preoperational and operational environmental monitoring program, and any supplements or revisions thereto, will be furnished to the Council and/or the agencies designated by the Council.

10. The Supply System agrees to comply with all environmental laws and regulations of the state and federal agencies.

(5) Provide plans for protection of the plant facility complex against damage from flood waters, tsunamis, and natural disasters, and security provisions against sabotage and vandalism.

Flood Protection

The Project will be designed in accordance with requirements of the AEC based upon elevation criteria provided by the U. S. Army, Corps of Engineers.

Natural Disaster Protection

The Project will be constructed in accordance with AEC criteria to withstand maximum winds based on wind data applicable to the Hanford Reservation.

The plant will be designed to withstand the ground motions resulting from the operating basis and design basis earthquake as defined by the AEC.

Fire Protection

The Project buildings and their contents will be designed and constructed so as to be largely fire resistant.

The Hanford Reservation has three modern fire stations located strategically in the Production and Research areas. Each facility is operated by ITT/Federal Support Services and is manned with two 4-man engine companies fully trained in all phases of fire suppression and rescue, including fires involving radiation.

Each fire station is equipped with three 750 to 1,000 gallons per minute engines, two 1,250 gallon capacity brush trucks, and one 5,000 cubic feet per minute high expansion foam unit. Special equipment available for all emergencies includes a 3,000 gallon capacity supply truck, two fully equipped rescue vehicles, and one 13,500 cfm high expansion foam truck, all radio equipped. The nearest of these three stations is not more than 7 miles from the Project and will be connected to the Project's automatic fire alarm network.

Other services available include decontamination of roads and walkways, controlled burning, complete fire extinguisher servicing, testing of automatic alarm systems in buildings, flow testing and flushing of water systems, demonstrations in the use of fire appliances, first-aid instructions, and disposal of hazardous materials.

These services as well as other services described herein may be contracted for with the Atomic Energy Commission in addition to the Supply System's installation of fire protection systems in the Project's facilities.

A diesel powered water system will be provided. Portable and fixed chemical extinguishers will be available to control any localized fires.

Patrol Protection

A plant protection service is provided by ITT/FSS for the AEC and its contractors, and consists of 183 uniformed patrolmen and 33 supervisory and clerical personnel. The primary responsibilities of the Patrol Section include access control of personnel into all limited and exclusion areas, guarding against plant espionage, sabotage, and related production interruptions, routine security checks of more than 400 buildings and many miles of fence lines;

providing emergency communication with a central radio station, seven stationary units, and 30 radio-equipped vehicles; traffic control enforcement on 270 miles of surfaced roads; escort duty in all security areas and on plant highways; operating ambulances; rendering emergency assistance to all contractors in case of fire, accident, catastrophe, and evacuations; investigating or assisting in the investigation of all Federal property, and enforcing property control measures at two plant barricades and the 300 and 700 Areas.

Site Perimeter Protection

The Supply System will fence the perimeter of the Project's buildings. The fence will be of cyclone type construction with intruder deterrent. The main gate approach will have television camera monitoring with remote control of gate operation from the Project's main control room. The entire Hanford Reservation is a controlled access exclusion area.

Annual inspections of the Project by the U. S. Army Provost Marshal's representative will be made to aid in reviewing items concerning Civil Defense. These annual inspections will be in addition to Supply System's attention to details of the plant Civil Defense needs. The Supply System will maintain a list of personnel with critical job skills for Civil Defense needs in times of emergency.

Flood Protection

Hanford No. 2 is located at an elevation that provides flood protection from the failure of any upstream dam. The river water makeup pumphouse will be affected by floods greater than the maximum flood of record (740,000 cfs, 1894), but this facility is not essential to the post shutdown cooling of the reactor. Core cooling water required for plant shutdown will be provided by Class I spray ponds near plant grade level and will provide the necessary heat dissipation in the event river water is not available.

Tornadoes

Section 2.3.1.5.2 of the Hanford No. 2 PSAR reports "within a hundred mile radius of the Site, only 14 tornadoes have been reported since 1916". The PSAR also states that the authorities on the subject estimate that the probability of an occurrence of a tornado in the vicinity of the Site is "six chances in a million during any given year or about one chance in 4,000 during a 40 year plant life". Even so, the design of Hanford No. 2 will include provision for structural integrity at wind velocities higher than 244 miles an hour including a maximum tangential wind velocity of 214 miles per hour.

The maximum pressure drop in the center of the tornado relative to the surroundings is estimated to be "1.6 psi for the 214 mile per hour tangential wind velocity".

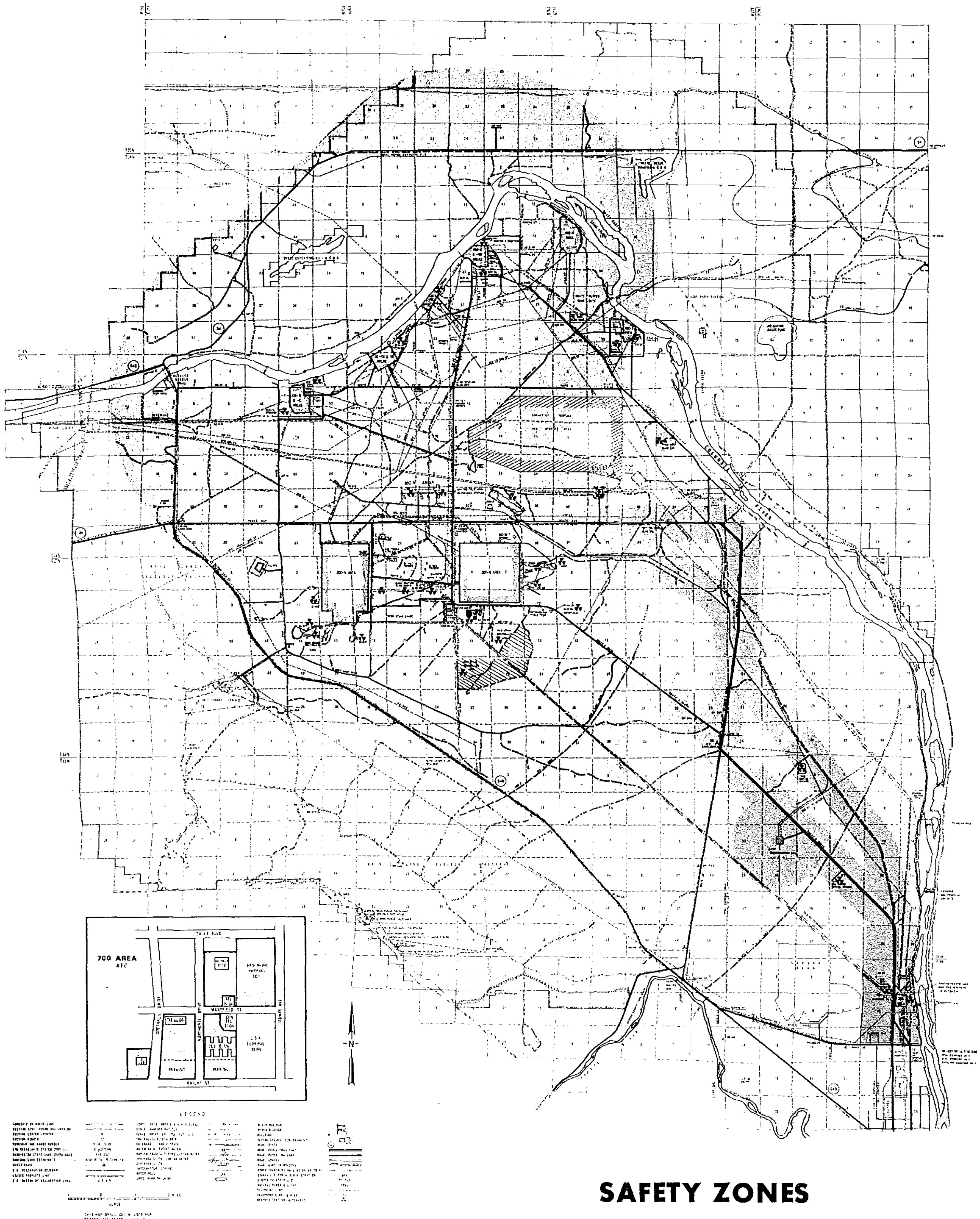
Earthquakes

A conservative criteria will be used for earthquake design of Hanford No. 2. The design accelerations will include a 0.25g design basis earthquake and a 0.125g operating basis earthquake.

Emergency Plans

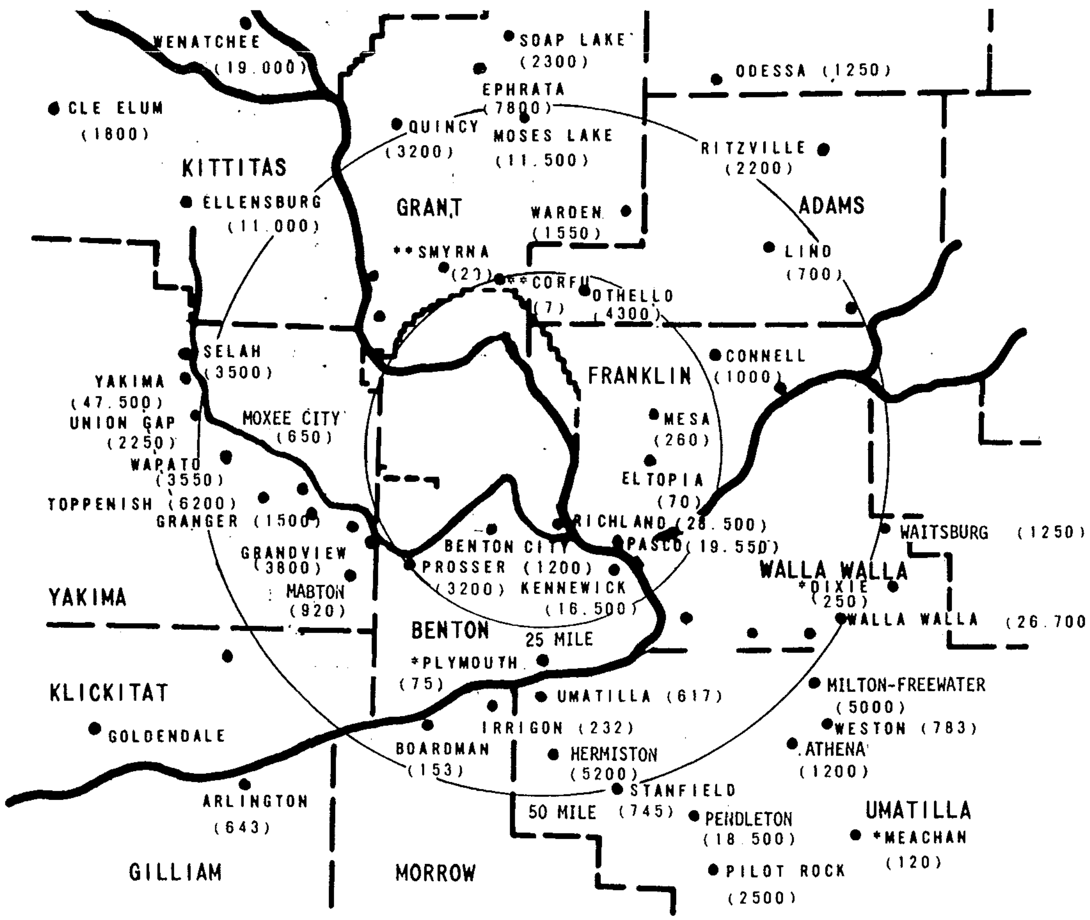
An outline of the Hanford No. 2 emergency plan is included in Section 015(2). This outline also sets forth the schedule for the preparation of the final emergency plans for the construction and operating phase in 1972 and 1976 respectively.

When possible, emergency services will be obtained through service contracts with qualified contractors on the Hanford Reservation. It should be re-emphasized however, that in the event such emergency services are no longer available to Hanford No. 2 operations, the Supply System will take the sole responsibility for maintaining the required surveillance and emergency program, protective equipment and all other services. In so doing, the Supply System recognizes that its organization and project management may have to be revised to incorporate security and fire protective services that are in compliance with all applicable local, state and federal statutes and regulations.



SAFETY ZONES

Figure 015-1



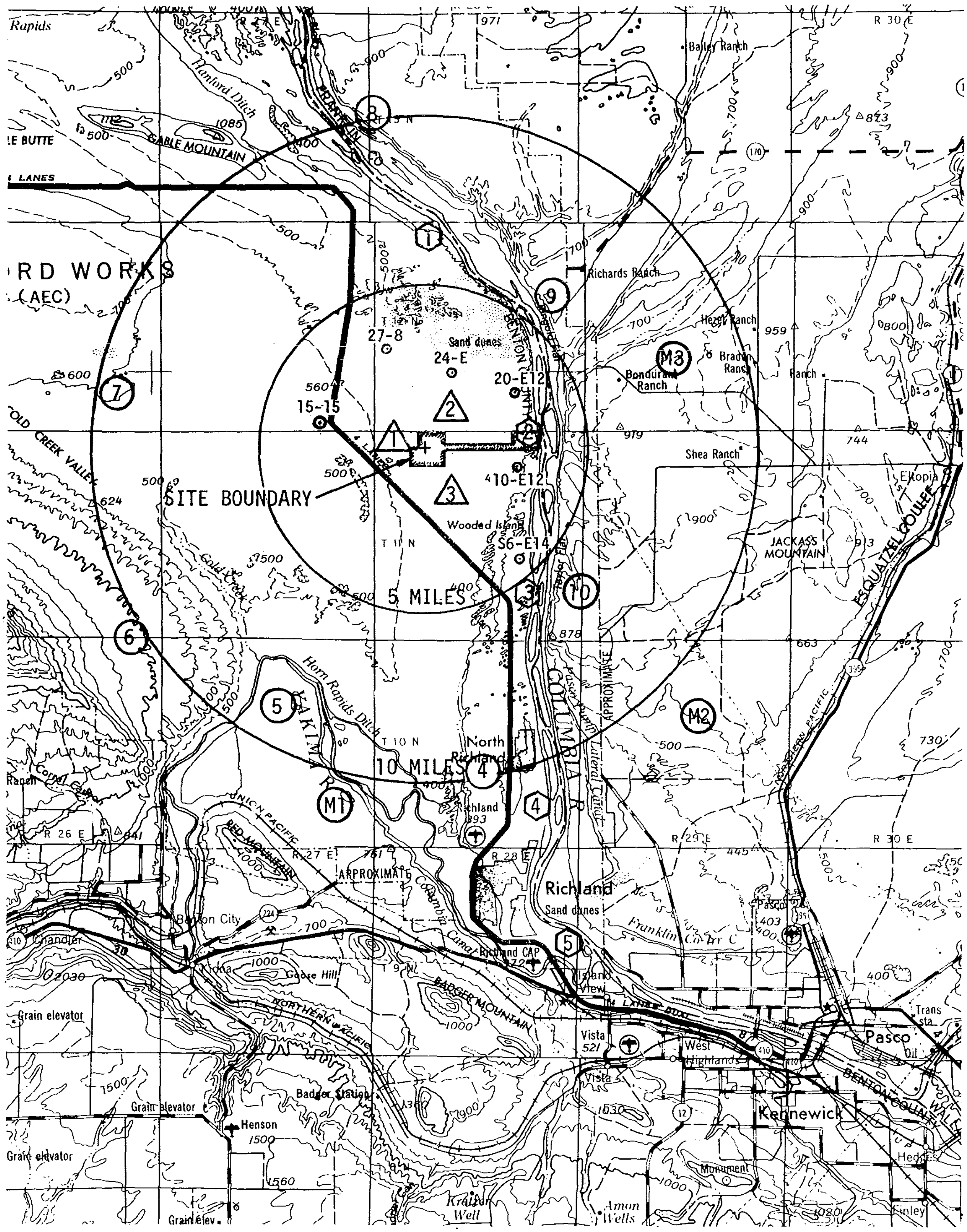
SOURCES FOR POPULATION DATA

* RAND McNALLY CO. COMMERCIAL ATLAS AND MARKETING GUIDE (1969)

** WASHINGTON STATE HIGHWAY DEPARTMENT ESTIMATES (1969)
ALL OTHERS ARE ESTIMATES FROM THE WASHINGTON STATE CENSUS BOARD (1970)

Population Distribution in a 25 and 50 Mile Radius Around the Site

Figure 015-2



SAMPLE STATIONS FOR RADIATION MONITORING
(See text for meaning of symbols)

Figure 015-3

Supp. Filing 8/20/71

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(2) Kastner, Jacob, The Natural Radiation Environment, USAEC, Div. of Tech. Information, Library of Congress Cat. Card No. 73-600865, 1968

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USAEC, Standards for Protection Against Radiation - 10 CFR 20

USAEC, General Provisions for the Licensing of Reactors - 10 CFR 50

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USAEC, App. 2401, Physical Protection of Classified Matter and Information Part VIII Trespassing on Commission Property, June 26, 1969

BNWL-SA-1606, Evaluation of Environmental Radiation Exposures in the Vicinity of Hanford - J. K. Soldat - June 15, 1966 - 30 p.

BNWL-SA-700, Evaluation of Environmental Radiation Exposures in the Vicinity of Hanford - J. K. Soldat - May 1966 - 20 p.

BNWL-SA-465, Environmental Monitoring, J. F. Honstead, J. K. Soldat, March 25, 1965 - 71 p.

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(3) U. S. Department of Health, Education, and Welfare, Public Health Service, Radioassay Procedures for Environmental Samples, January 1967.

(4) Wilson, C. B. and Essig, T. H. (editors), Evaluation of Radiological Conditions in the Vicinity of Hanford for 1969, USAEC Doc BNWL-1505, Nov. 1970.

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(8) 10CFR50, Appendix E, "Emergency Plans For Production and Utilization Facilities," Dec. 24, 1970.

(9) AEC, "Guide to the Preparation of Emergency Plans for Production and Utilization Facilities".

Section 020

Land

(1) Furnish plans for the control of surface water run-off to prevent water pollution or adverse water quality changes in variance with the water quality standards.

Supply System Project designs will include measures for avoiding uncontrolled surface water run-off both during periods of construction and operation.

Erosion control will be accomplished by providing necessary grading, water bars, terracing or landscaping. Where special factors make it unusually difficult to establish protective programs, other restoration procedures may be necessary such as channels, catch basins, settling ponds, culverts or treatment by gravel and riprap or other appropriate means.

The rainfall at the Hanford Reservation averages 6.4 inches per year. The surface soils are permeable and minimal natural surface run-off occurs.

A description of the Supply System plans and specifications for erosion control, borrow pits, earth fills and restoration are contained in the supplemental filing 7/1/71 and 9/27/71 in Section 020(2).

All Supply System construction contracts will contain a section entitled "Excavation Filling and Backfilling" which will utilize published Corps of Engineers' standards such as the Department of the Army TM5-820 Series, and Guides & Specifications for Military and Civil Works Construction, CE-203. These specifications contain published standards for compaction, clearing, grubbing, excavation, drainage, shoring, blasting, borrow, filling, testing, and references to standards published by federal agencies, military codes and the American Society for Testing & Materials criteria.

The Supply System will furnish a copy of the Hanford No. 2 standards for control of water pollution to the Council or an agency designated by the Council.

Figure 010-9, SUMMARY SCHEDULE, illustrates that major site construction will commence in 1973. The construction of the Intake, Outfall and the barge slip will be the only major construction activity to be conducted in or adjacent to the Columbia River.

As shown in Figure 025-6, the intake structure will be well inland of the channel line of the river so any surface or groundwater affected by this construction will be treated by the use of percolation or settling ponds to prevent any adverse effect on water quality.

Dredging will be required along the right bank of the river to install the filter bed, the intake bed and the return line. The slopes of the embankments will be protected with rip-rap, if necessary, to control erosion. It is not anticipated that fill other than filter bed material will be placed in the river.

A temporary barge slip will be dredged on the shoreline to receive heavy equipment items such as the reactor vessel. The Supply System will comply and will require all construction contractors to comply with all federal, state and local codes and regulations applicable to the construction of a barge slip. To assure minimal environmental impact due to dredging operations, the Supply System will develop plans jointly with federal, state and local agencies having departmental interest or regulatory authority over plans, designs, schedules and restoration of the construction area. The Supply System will comply, and will require its contractors to comply, with all conditions and limitations imposed by permits and approvals required for construction of the intake structure filter bed, outfall line and barge access slip.

The protection of the Hanford No. 2 site from wind and water erosion is contained in Section 020(2), page 1 and the supplemental filings 7/1/71 and 8/20/71 for that section.

(2) Provide plans for the excavation of borrow pits, disposal of surplus excavation or spoil material and earth fills which are designed to minimize erosion.

General

In all cases of planning for borrow pits and spoil areas, the Supply System will maintain a policy of (1) limiting the amount of raw soil exposure, (2) protecting the exposed areas from erosion by wind and water, and (3) encouraging restoration of vegetation by natural methods or reseeding in areas where special treatment is appropriate.

Borrow Pits

Preparation of borrow pits will include grading so as to minimize wind and water erosion and conform as much as possible to the natural topography. Accumulation of any precipitation within the excavation will be collected in a sump and allowed to infiltrate into the permeable soils thereby preventing interference with operations in the borrow pit.

Surplus Excavation or Spoil Material and Earth Fills

Plans for deposition of excess (spoil) material will include provisions to minimize wind erosion and will include grading to reasonably conform to existing topography as well as shaped to control surface water runoff. This will include such practices as sloping at less than natural angle of repose and shaping the top of the spoil area to retain moisture and encourage revegetation.

Surface Water Runoff Control

Hanford No. 2 Site is located on flat lands, with only minor relief, consisting of some shallow rolling with the eastern extremity having a general slope to the river. Surface drainage is good due to the open nature of the surface soil and low rainfall is a factor in minimizing drainage problems.

During construction, contractors will be required to maintain proper drainage and erosion control around construction areas and especially in areas of excavation or fill. This shall include construction of low berms along the top ridge of excavation areas, grading away from the excavation, mechanical dewatering and treatment of excavations when necessary, and control of embankment drainage. Slopes of embankment shall be as recommended by the soils consultant. All of these practices shall be included in a standard construction specification section entitled "Excavation Filling and Backfilling". All construction and permanent erosion and drainage controls will be based on the Corps of Engineers' Practice and Manuals (Department of the Army TM 5-820 series).

WAC 463 12-020 - QUALITY OF THE ENVIRONMENT - LAND

(3) Furnish plans for the associated transmission line routes so as to avoid scenic, recreational, historical, archaeological, heavily timbered areas, steep slopes, and proximity to highways were possible; and to minimize conflict between the rights-of-way for present and forseeable uses of the land on which they are to be located.

All new transmission lines required by the Project between the proposed Site and the Bonneville Power Administration Hanford 500 kv switchyard will be located entirely on the Hanford Reservation.

The Hanford Reservation is so located that the transmission lines from the Project to the BPA 500 kv substation in the Hanford 100-N Area will not affect areas considered scenic, recreational or historical.

The Project's transmission lines will not traverse timbered areas, nor be located in the proximity of State highways.

There are a limited number of archaeological sites on the Hanford Reservation, but wherever prehistoric man and recent Indian cultures have had camp and burial grounds they will be avoided by the transmission routes. These sites are identified in Section 010 (6).

No conflicts with right-of-way are anticipated within the AEC managed Reservation.

The "Environmental Criteria for Electric Transmission Systems"[1] prepared by the United States Department of the Interior and Department of Agriculture under requirements of the National Environmental Policy Act of 1969 will be used as the guide.

WAC 463-12-020(3) - QUALITY OF THE ENVIRONMENT - LAND - TRANSMISSION LINE ROUTES (Supp. Filing 8/20/71)

The routing and design of the transmission lines required for Hanford No. 2 will comply with the February 1970 "Environmental Criteria for Electric Transmission Systems" published by the U. S. Department of Interior and Department of Agriculture.

The corridors of the three proposed transmission lines to be constructed between the Hanford No. 2 and the Bonneville Power Administration transmission grid are shown on the folded map of the Hanford Reservation utilities included with the August 20, 1971 submittal for insertion in the back of this binder.

The transmission line requirements for Hanford No. 2 are discussed in Section 010(4) page 3 (Supp. Filing 7/1/71). These transmission lines include (1) a 500 KV single circuit transmission line extending 18.3 miles to connect with the Bonneville Power Administration 500 KV switchyard near Hanford No. 1 on the Reservation, (2) a 230 KV single circuit "station service" transmission line extending 11.5 miles on the Reservation to connect with an existing Bonneville Power Administration 230 KV transmission line and (3) a 115 KV single circuit "backup" power supply interconnection extending approximately one mile on the Reservation south to interconnect with the Bonneville Power Administration line from the Benton switching station to the FFTF site. The Benton switching station and the FFTF site are illustrated by the folded map included with this filing.

The construction schedule for the three transmission lines is listed in Section 010(4) - Page 4.

All transmission line connections are located within the Hanford Reservation with the minor exception that part of the existing BPA 230 KV "station service" line extends to the Midway Substation which is west of, and immediately adjacent to, the western boundary of the Hanford Reservation.

The terrain over which the transmission lines will pass is primarily level land with natural coverage consisting of sagebrush interspersed with desert grasses. The colored photograph "Aerial Closeup of Hanford No. 2 Site Looking Southwest" contained in Section 040 of this application illustrates the typical terrain.

The lease of the Hanford No. 2 Site from the AEC will contain a grant of reasonable rights-of-way to the Supply System for power lines over the AEC lands. The exact location of the transmission line corridors and the legal description thereof will be available prior to December 31, 1973 and will be filed with the Thermal Power Plant Site Evaluation Council. Any change in the routing of the 500 KV line to Hanford No. 1 from the approximate routing shown by the folded map will be discussed with the Council at that time.

Preparation of design criteria to comply with the "Environmental Criteria for Electric Transmission Systems" referenced above will require that the transmission line must be planned so as to avoid scenic, recreational, historical, archaeological areas, steep slopes and proximity to highways.

(4) (a) Conduct a comprehensive geologic survey to determine geologic conditions of the site with particular attention to the nature of the foundation materials and recorded seismic activities; (b) geologic information will continuously be evaluated during preparation of the site for construction and appropriate steps taken in design and construction of the plant, recognizing the geologic conditions.

For more than 25 years the geology of the Hanford Reservation has been intensively studied. No other comparable land area in the United States has been so thoroughly studied by geologists. Over 1500 test wells have been dug and local foundation studies performed at each of the existing facilities. Appraisals of the seismicity in the area have been conducted on both a local and regional scale.[2]

The geological characteristics of the Hanford Reservation are summarized in Geological Factors Relating to Engineering Seismology in the Hanford Area, Jahns, Richard N.; DUN-3100, October 1, 1967,[3] which is incorporated herein by this reference. Further information may be found in Geologic Investigation of Faulting in the Hanford Region, Washington, Bingham, Londquist & Baltz, U. S. Geological Survey, 1970 (Open File).[4]

Geology

The Hanford Reservation lies in the approximate center of the Pasco Basin, the structural and topographic low point of Eastern Washington and the Columbia River Basalt Plateau. The region is underlain by three major geologic units: (1) the basaltic lavas and intercalated sediments of the Columbia River Basalt Group at the base, (2) the Pliocene-age Ringold Formation, and (3) the Pasco (glacio-fluvial) gravels and associated sediments of late Pleistocene age at the surface.

Stratigraphy

The Columbia River Basalts are more than 10,000 feet thick and probably about 12,000 feet thick.[5] They thus extend to a great depth below sea level on the Reservation (See Figure 020-1). Their position resulted from long, slow and steady basining as identified by Brown[6] probably from early Pliocene time, hence are probably greater than 17,000,000 years old.

The basalts and their associated sedimentary interbeds are overlain by the Ringold Formation sediments of Pliocene to perhaps early Pleistocene age. They are deposits of an ancestral Columbia River and were laid down following cessation of emission of the basalt flows. To a large extent they were deposited on the flood plain of the Columbia River when its base level was raised by the rising anticlinal mountain ridges (See Figure 020-1) and the Horse Heaven Hills.

The Ringold Formation has been arbitrarily divided into a lower, so-called "blue clays", a middle conglomerate, and an upper fine sand and silt. The "blue clays" are known solely from drilled wells, but samples consistently show they are largely compact and calcium carbonate-indurated silts. They thus are comparable to the silts in the uppermost part of the Formation which, in an oxidizing environment, have become tan to brown in color.

The conglomerates generally blanket the silts, although they also interfinger with them in part. They are in turn overlain by the silts and sands of the uppermost part of the Formation. These silts and sands are known only from White Bluffs, for they or their equivalents were eroded from the Hanford area (See Figure 020-2).

Where exposed to weathering, as in the White Bluffs, the Ringold tends to soften and to be subject to sliding and sloughing. However, when subject to the surcharge of appreciable cover, and protected from weathering, the Ringold Formation takes on the aspect of bedrock. Observed compression wave velocities in the neighborhood of 10,000 fps describe its properties in the subsurface.

The Pasco Gravels and their fine-grained variant, the Touchet Beds, are the compact though uncemented deposits of late Pleistocene and early recent times. They were laid down by glacial meltwaters and glacial lake floodwaters between about 100,000 and 10,000 years ago. Evidence suggests that the sediments in places were buried by perhaps 200 additional feet of gravel that later were swept away.

The Pasco Gravels, because of their manner and deposition and depth of burial, have a stability and load bearing capacity considerably in excess of that experienced with normal alluvium.

The gravels occur at the surface, or under a thin cover of loessial materials. The water table is controlled by the Columbia River elevation. The Ringold Formation over much of the area occurs near the river level. The gravels are, therefore, typically unsaturated. The construction of the proposed Ben Franklin Dam will raise the water table to an elevation as high as 420 feet, saturating the gravels. If the Ben Franklin Dam is built, studies of the dynamic behavior of the Pasco Gravels in a saturated state may be necessary.

Structure

The Hanford Reservation lies in the center of a major structural basin traversed by largely east-west trending anti-clinal (upfolded) mountain ridges. The ridges, as deduced by geological studies and the determined age of the Ringold Formation (which resulted from their uplift), began to rise somewhat more than 10,000,000 years ago. Uplift has been slow and continuous, comparable to basining.[7]

Many "faults" have been postulated within the anticlinal structures by various workers, including most recently Jones and Deacon[8] who based their work almost solely on interpretation of aerial photographs. Where sufficiently detailed field work has been done, most of the faults are clearly secondary features of limited longitudinal and probably vertical extent, and of small offset. Other "faults" have proved to be sites of complex folding, in some instances complicated by erosional processes, thus leading to an overly pessimistically "faulted" basin. The results of recent U. S. Geological Survey work does not support the works of Jones and Deacon although additional and more definitive work in additional sites was recommended. The offset was associated with part of the folding and uplift of the anticlinal ridges where the stresses that accumulated during folding could not be relieved solely by slippage on the many joints and bedding planes. Recent work also indicates that much of the offset on several faults occurred during Ringold Formation time, more than 500,000 years ago and possibly several million years ago. The offset then evidently was associated dominantly with a period of significant uplift and folding, with lesser if any offset in subsequent time in spite of some suggestion of continued tectonic activity. In one instance the last movement pre-dated flood deposits more than 40,000 years old.[9] In another, the last movement was more than 10,000 years old. Those faults are believed typical. To date no sign of fault movement in the last 10,000 years has been identified in the Pasco Basin. Efforts currently are underway by Battelle Northwest Laboratories to more precisely date the deposits of the floods.

Few faults have been identified or even hypothesized for the synclinal (downfolded) or valley areas.

Seismology

The seismic history of the general Hanford area must be considered in the context of the seismicity of a larger area which includes the entire State of Washington and the Columbia Basin. Table 020.4-1 shows the Rossi-Forel, the Modified Mercalli, and the Richter scales which are used to describe the intensity of the earthquakes.

Landslides

Landslide masses, some of considerable size, are widespread in the Hanford region. Most are in the Ringold Formation and in parts of the basalt section where failure has occurred along interlayered pyroclastic or sedimentary materials. Some of these slides may indicate recent or even historic tectonic activity, as suggested by Jones and Deacon[8], but fundamentally they reflect special combinations of topography, weak materials, geometry of layering in these materials, and distribution of subsurface water (See Section 025(1c)). Triggering by earthquakes may well have occurred at many localities; that such triggering need not have required very strong shaking, however, is indicated by the large number of landslides in this region for which new or renewed movement is known to have begun during recent periods of seismic inactivity.

Faulting and Seismicity

The Hanford Reservation lies in Zone 2 of the latest (1969) U. S. Coast and Geodetic Survey seismic probability map, and the Uniform Building Code (See Figure 020-3). Other authors place Hanford in Zone 1, bordering on Zone 2.[10] They thus corroborate the earlier work of Neumann[11] who stated "Hanford ...

may be considered in one of the safest seismic areas in Washington State....". The seismic zoning is at best an arbitrary generalization, but is based upon the worst damage that has historically occurred. That damage is generally upon saturated, consolidated alluvium. The late Pleistocene and recent sediments at Hanford are compact though unconsolidated, and are unsaturated.

Recently proposed but not yet adopted or implemented U. S. Atomic Energy Commission siting criteria[12] for nuclear reactors apply an arbitrary close correlation between earthquakes and surface faults. Thus, if surface faults or structures capable of faulting (monoclinal folds) exist in an area, earthquakes shall be considered possible along that structure at the point closest to the reactor site. In addition, a suitable factor of safety (conservatism) must be introduced to allow for the maximum credible earthquake.

Three zones are considered of concern in the Hanford area. They include the Gable Mountain-Umtanum Ridge structure, the Saddle Mountains, and the Rattlesnake Hills to Wallula topographic and in part structural alinement. The Gable Mountain-Umtanum Ridge structure is considered to be of little concern because (1) one fault mapped by Jones and Deacon in Gable Butte proved to be non-existent although they indicated up to 1000 feet of lateral offset. Exploration disclosed solid basalt across the trace of the "fault". Evidence for the "fault" proved to be a sinuous anticlinal axis. (2) A fault on Gable Mountain, with suggested offset of 2/3 of a mile proved to be two overlapping en echelon anticlines with minor faulting on the noses of each. (3) The age of the latest movement on the fault(s) was determined greater than 40,000 years.

The Rattlesnake to Wallula lineament was postulated by Jones and Deacon to be a major fault extending to Milton-Freewater, the site of a Modified Mercalli VII intensity earthquake in 1936. Considerable controversy exists about the nature, importance and continuity of the structure along the zone, and in fact whether the earthquake occurred on that structure. Thus, breccias that occur in some of the buttes along the zone have not been demonstrated to exist in the much more extensive intervening and covered areas. Part of the total zone is clearly faulted, possibly en echelon in nature, but continuous faults have yet to be demonstrated. To date evidence at several sites suggests that no movement has occurred in the last 12,000 years, comparable to findings on the more northerly structures. Jones and Deacon felt that the Corfu earthquake of 1918 occurred along the Saddle Mountains fault and that recent offset had occurred there. Exploration by the Geological Survey disclosed that what Jones and Deacon had thought was evidence of recent offset was the effect of block glide of a large landslide block, probably during the glacial Lake Missoula floods. The last movement on the fault was concluded to be more than 10,000 years ago, for flood gravels, at least that old, are undisturbed where they cross the fault.

Although the Corfu quake was named for the townsite on the north side of the Saddle Mountains, Jones and Deacon identified the epicenter of the quake as 10 miles south of Corfu.

Fifer[13, 14] concluded on the basis of interviews with old-time residents of the area and the original description of the quake that it in fact occurred at Corfu. J. C. Tison, Director of the Environmental Science Services Administration, on December 13, 1967, concurred that the quake occurred "a few miles north of the (Hanford) site"[15] rather than on it as Jones and Deacon have stated.

The intensity of the Corfu quake also has unexplainably been raised from the Rossi-Forel IV (modified Mercalli IV to low V) which the initial description and conversion indicate, to the Modified Mercalli VI intensity which Jones and Deacon cite. Fifer and Jahns[13, 3] cite the field evidence for the lower value.

The greatest earthquake historically felt at Hanford (but occurring elsewhere) was Modified Mercalli IV intensity for the State Line (Milton-Freewater) quake of 1936. A Modified Mercalli VI intensity quake is considered a reasonable possibility, with a Modified Mercalli VII intensity quake the "strongest that reasonably could be expected".[3] This is consistent with the Zone 2 categorization by the U. S. Coast and Geodetic Survey and the Uniform Building Code. Modified Mercalli VII intensity earthquakes now are considered the "maximum credible quakes although such earthquakes clearly characterize a Zone 3 seismic probability.

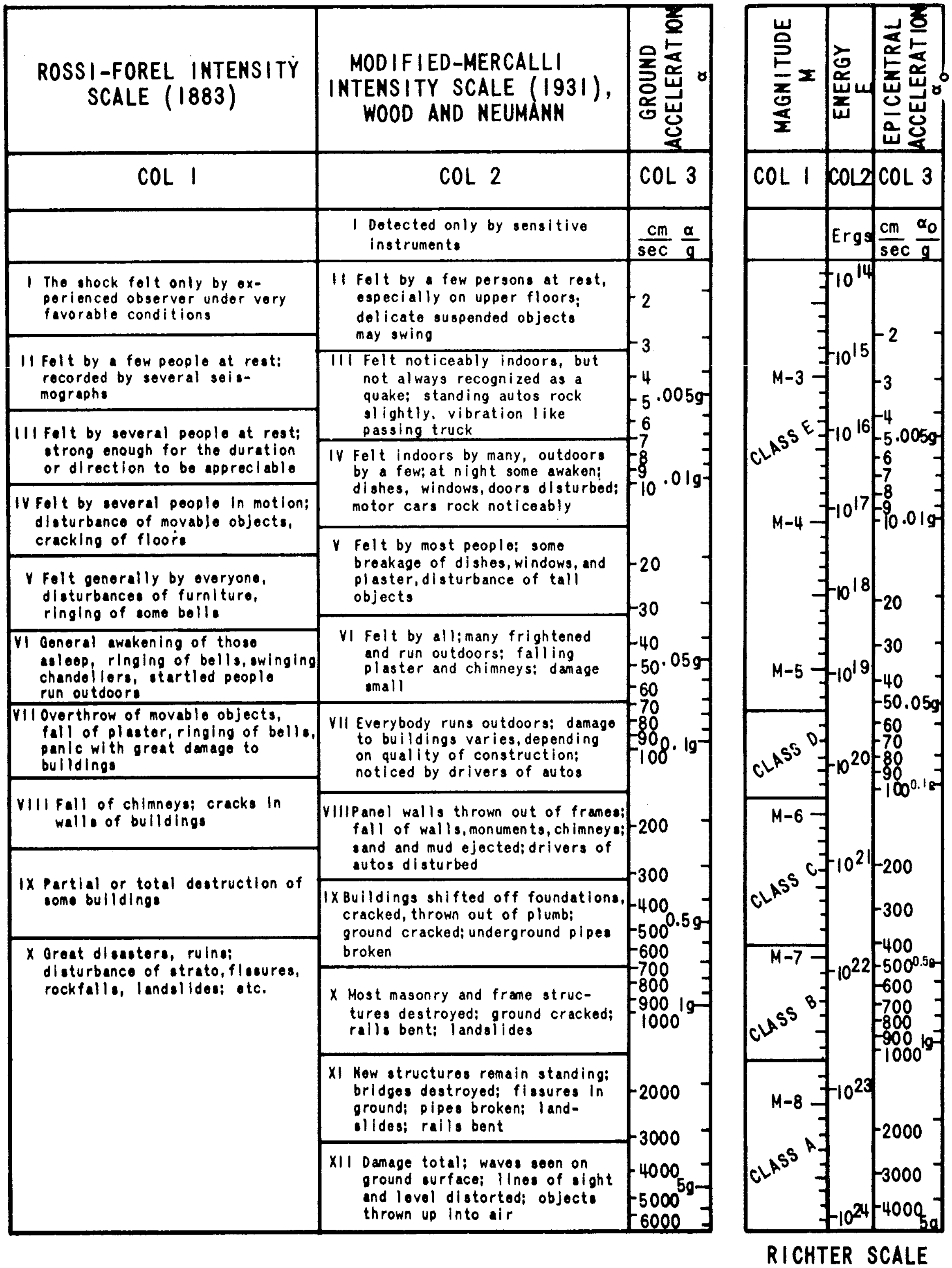
In the light of present knowledge a Design Basis Earthquake Acceleration of 0.25 g and an Operating Basis Acceleration of 0.125 g are regarded as properly conservative for any site on the Hanford Reservation other than Gable Mountain.

Current Research

Current research by Battelle Northwest Laboratories, is seeking to better characterize the geologic structures along which faults occur and to identify the nature and significance of those faults. Work is also proceeding to better identify the age of the various flood deposits so that better ages of the last movement on the faults can be determined.

Improved and additional instruments will be installed at all new reactors at Hanford to identify the nature of both microseismic and macroseismic activity that may occur, and to relate it to geologic features.

In addition the Supply System will conduct an on-site geophysical investigation, prepare a dynamic soil model and develop an appropriate design earthquake spectrum for the site.



Approximate Relation Connecting Earthquake Intensity With Acceleration

Table 020.4-1

II. Supp. Filing 8/20/71 Summary of Foundation Investigation by Shannon & Wilson, Inc. *

<u>Summary</u>

Shannon & Wilson, Inc., Soils Mechanics and Foundation Engineers of Seattle, Washington, performed a comprehensive foundation investigation at the site of the proposed Hanford No. 2 Nuclear Power Plant during the period April-May 1971.

The purpose of this investigation was to determine the subsurface conditions underlying the power plant structures and to make detailed recommendations for design and construction of the foundations for the major buildings. For this investigation, Shannon & Wilson drilled 11 exploratory borings to depths ranging from 77 feet to 250 feet within a 400-foot-square area at the proposed location of major buildings. Laboratory tests were performed on representative samples recovered from the borings to determine the applicable physical and engineering properties. These tests, in addition to a detailed visual classification of each sample, included: water content determinations, grain size analysis, maximum and minimum density determinations, permeability tests, compaction tests, resonant column tests and repetitive triaxial tests.

Using the results of data obtained in the field and in the laboratory, Shannon & Wilson then performed analytical work to draw conclusions concerning various engineering properties of the foundation soils and to make recommendations for design and construction of foundations for the major plant structures.

"The field explorations indicate that the Hanford No. 2 site is underlain by dense granular soils to at least a depth of 250 feet, which corresponds to the depth of the deepest boring. The entire site is mantled with a 2 to 3-foot layer of fine, eolian SAND. This thin blanket is immediately underlain by about a 100-foot thick deposit of fine to coarse SAND, which varies in consistency from slightly gravelly to that of a sand and gravel mixture. In the upper 40 feet, these sands increase in density with depth from medium dense to very dense. Below a depth of about 40 feet, all soils were found to be very dense, as indicated by penetration test values which were with a single exception greater than 100 blows per foot. Below an average depth of 107 feet, the borings encountered the extremely dense Ringold conglomerates (sand-gravel mixtures), which are underlain at about 217 feet by the lower unit of the Ringold Formation consisting primarily of very dense or hard,

* - Shannon & Wilson, Inc., "Foundation Investigation, Washington Public Power Supply System, Hanford No. 2 Nuclear Power Plant, Central Plant Facilities, Benton County, Washington", May 28, 1971.

interbedded sand, silt, clay and gravel. The water table was measured to be at an average depth of 62 feet and the estimated top of basalt bedrock is approximately 420 feet below the ground surface as determined by geophysical methods."

On the basis of mat foundation configurations described by Burns & Roe, Inc., and the dense granular soils underlying the proposed site, Shannon & Wilson concluded that: ". . . the ultimate soil bearing capacity is in excess of 50 tons per square foot. Thus, the allowable bearing pressure for these structures will be governed by the differential settlements that may be tolerated. Based on the present design loads, the proposed depth of excavation, and average elastic moduli (E) of 25,000 psi, 60,000 psi and 90,000 psi for the major soil zones, the maximum elastic settlement that will occur during construction is computed to be slightly more than 2 inches, while the maximum differential settlement should be in the order of 1 inch. Maximum post-construction differential settlements should not exceed about 0.25 inch. The strip footing foundations for the diesel generator building and the truck lock, and the spread footings for the service building will need to be designed for somewhat lower bearing pressures than the broader mat foundations.

"Because of the very dense nature of the foundation soils, there is no possibility for the occurrence of soil liquefaction beneath the major structures. Due to the possibility of a future groundwater rise, all subsurface structures will require waterproofing to resist hydrostatic pressures or the use of a dewatering and drainage system. No additional settlements are anticipated as a result of changes in groundwater level.

"Criteria have been developed and presented regarding the placement and compaction of structural fills as well as the lateral pressures such fills, backfills and adjacent foundations will exert on subsurface, exterior walls. In general, we recommend that these walls be designed for coefficients of earth pressure at rest which vary from $K_o = 0.5$ to 0.8. Where applicable, active and passive pressure coefficients may be used as given.

"We have concluded that the soil conditions at the proposed site are suitable for the design and construction of the central facilities presently planned. However, it is recognized that additional explorations will be required for both the major central plant structures and various minor structures associated with the plant. In general, such explorations would be confirmatory in nature to verify that the anticipated conditions at other site locations are consistent with the conclusions reported herein."

Discussion

Excerpts from the May 28, 1971 report by Shannon & Wilson are reproduced in the following discussion of detailed results of the subsurface investigation and conclusions and recommendations related to foundations and structures that were derived therefrom by Shannon & Wilson. These excerpts include the revisions dated 8/5/71.

1.0 Subsurface Conditions

"The subsurface conditions encountered beneath the plant site to a maximum depth of 250 feet are depicted in the Subsurface Profiles, Fig. 020-6. In general, three basic soil types were encountered in the borings. In descending order, these soils consist of: 1) fine surface SAND, 2) relatively clean, uncemented SAND and GRAVEL, and 3) sandy and gravelly CONGLOMERATE with silty and clayey zones. The following . . . sections . . . discuss . . . each of these basic soil types and their physical characteristics . . . average soil conditions at the plant site . . . certain engineering properties . . . site response calculations, and . . . an evaluation of the groundwater conditions.

1.1 Surface Sand

"Mantling the entire plant site is a relatively thin layer of fine, slightly silty, eolian SAND (locally referred to as blow sand), which ranges from 1.5 to 3 feet in thickness. Based on gradation curves of select samples, and visual classification of all near-surface samples, these surface sands are classified as SP or SM according to the Unified Soil Classification system. These sands are generally brown to light brown, or tan in color, and have a relative density varying from loose to medium dense. The measured water content of this material averages about 6 percent. The laboratory permeability of the surface sands, recompacted in a loose to medium dense state was measured and computed to be 7.8×10^{-4} cm/sec. Based on our experience with other nearby sites, we anticipate that the average permeability of this material is slightly greater than this single laboratory test indicates.

1.2 Sand and Gravel Deposits

"Underlying the thin layer of surface sand is a relatively thick deposit of uncemented granular soil, which extends to an average depth of about 107 feet below the ground surface. These materials, geologically, constitute portions of two formations, namely: glacio-fluvial deposits, underlain by a sandy and gravelly unit of the Ringold Formation. The distinction between the two formations is difficult to determine precisely at this site because the caliche and Palouse soils that mark the surface of the Ringold Formation throughout much of the Hanford area are missing. However, based on the penetration resistance of these materials, a comparison of average gradation curves and local gradation changes noted in the boring logs, the interface between these two zones is estimated to be an average of 40 feet below the ground surface (approximately elevation 398$\pm$).

"In the upper 40 feet of this deposit, the soils consist predominantly of SAND which is light brown to dark gray in color. This sand varies locally in gradation from fine to coarse, is relatively clean to slightly silty, and generally contains considerable fine gravel throughout. Based on gradation tests, these soils generally correspond to either an SM or SW classification, or a combination of the two symbols, according to the Unified Soil Classification system.

"Below 40 feet, the soils consist of a complex interbedded system of reasonably well graded sands and gravels. Locally, as noted on the boring logs, either sandy GRAVEL zones (GM-GW) or gravelly SAND zones (SM-SW) may exist within any given depth interval. Both the sands and gravels have particles which are generally rounded to subrounded. Occasional cobble zones are also present. Although no boulders were encountered in the borings, they have been encountered in other borings, especially those drilled near the Columbia River.

"Most of the existing major facilities on the Hanford Reservation have been founded within and supported by these sands and gravels. Likewise, most of the proposed Hanford No. 2 Plant structures will be founded within the upper 40 feet of this deposit.

"The relative density of the sand and gravel deposits, as indicated by the field penetration resistance tests summarized in Figs. 020-7 and 020-8, generally increases with depth from medium to dense or very dense in the upper 40 feet. Below this depth, the penetration resistance indicates the presence of very dense soils in essentially all cases. Exposure of similar materials on Gable Mountain, together with other geological considerations indicate that these sediments were once deposited to at least elevation 800 feet, which is about 360 feet above the present ground surface at the Hanford No. 2 site. Thus the soils beneath the plant site probably have been preloaded by loads far in excess of those to be expected from the reactor and other buildings.

"Other physical properties and permeability were determined for select specimens in the laboratory using standard test procedures. The average properties from these tests are summarized in Table 020.4-2. Also specialized tests, consisting of resonant column and repeated loading triaxial tests, were performed to evaluate the moduli and damping factors.

Table 020.4-2

Average Soil Properties-Sand and Gravel Deposits

1)	Approx. Average Water Content Above Water Table	6%
	Approx. Average Water Content Below Water Table	10%
2)	Mean Grainsize Above 40'	0.45 mm
	Mean Grainsize Below 40'	1.90 mm

Density Determinations

3)	Maximum Dry Density	Minimum Dry Density	Depth	Material
	132.3 pcf	107.1 pcf	16 ft.	Sand
	118.2 pcf	98.4 pcf	20 ft.	Sand
	110.2 pcf	99.6 pcf	25 ft.	Sand
	115.1 pcf	104.7 pcf	35 ft.	Sand
	136.6 pcf	115.0 pcf	40 ft.	Gravelly Sand

Table 020.4-2
(Continued)

4) Permeability	Depth	Material
4.2×10^{-4} cm/sec	10 ft.	Sand
1.1×10^{-2} cm/sec	35 ft.	Sand
2.1×10^{-4} cm/sec	65 ft.	Sand & Gravel

1.3 Conglomerate Deposit

"Beneath the sand and gravel deposits at an average depth of 107 feet, the borings encountered the middle unit of the Ringold Formation. This readily identifiable CONGLOMERATE, consisting of a multicolored gravel in a slightly clayey to silty sand matrix (GM or SM), was partially penetrated by nine of the borings, two of which (B-1 and B-9) extended completely through this unit and into the lower unit of the Ringold. The middle unit has an approximate thickness of 110 feet.

"Borings were extended into this formation primarily to verify its competency as well as to establish the general classification and pertinent engineering properties of these materials for use in site response calculations. The very high penetration resistance, with blow counts per foot far in excess of 100 in 79 tests, establishes its very dense consistency. In general, this formation is relatively uniform with depth, though occasional sandy or cobbly zones were penetrated. In three borings (B-1, B-2 and B-3) a relatively thin (4 to 9 foot) layer of hard, tan, fine sandy SILT was encountered directly overlying the Ringold CONGLOMERATE.

"Because of the very high density of this material, only minimal specialized testing was accomplished or considered necessary.

"The lower unit of the Ringold, penetrated in borings B-1 and B-9 at an average depth of 217 feet, was likewise found to be very competent, so much so that identification samples were difficult to obtain since these materials were difficult to penetrate with conventional soil sampling devices. The lower unit is classified much the same as the middle unit. The predominant distinguishing features are its darker color and a slightly greater percentage of fines. The complete penetration of this layer and into underlying rock with borings was not accomplished nor considered necessary as the available information including the results of the present investigation, demonstrate that these deep materials are very competent rock-like materials. Consequently, we believe that the sampling and testing of soils and rock below a 250-foot depth is not required for the prediction of the behavior of a power plant founded at the proposed location. To obtain the general classification of materials below the plant site borings, reference should be made to the brief geology section of this report or directly to the logs of deep borings made at nearby sites.

"Directly underlying the Ringold Formation is basalt bedrock of the Yakima Formation. Based on a seismic refraction survey recently completed at the site, the depth to rock at the plant is indicated to be about 420 feet.

1.4 Average Soil Conditions

"In the investigation and evaluation of potential nuclear power plant sites, it is necessary to predict the site response under earthquake loading for structural design. For plants founded in soil, this requires the determination of the average subsurface conditions, including: groundwater, soil classification, average stratification and lateral distribution of the soil materials and the pertinent engineering properties of each layer. Also the depth to bedrock or dense, rock-like soils must be assessed within reasonable limits. Based on the data obtained from our field and laboratory investigations, together with other available data, we have evaluated the soil conditions and properties and present part of this information as a function of depth in the Generalized Soil Profile in Fig. 020-9. This profile can be considered as representative for all of the central plant structures since the soils throughout the site appear to be relatively uniform, with the interface elevation of successive major layers generally not varying more than about 5 feet between borings. Although the data shown in Fig. 020-9 have been projected to extend to bedrock, the upper soil materials are sufficiently dense or rock-like that input seismic bedrock motions, in our opinion, may be placed at the top of the sand and gravel conglomerate (107 feet). However, this decision is left to those performing the site seismicity evaluations.

"In addition to the above subsurface conditions and parameters, the dynamic soil properties, including moduli and damping factors also must be assessed as a function of depth. These dynamic properties are essentially strain dependent and therefore their magnitudes vary according to the time history of the shear stresses applied by the design earthquake at the appropriate depth interval being considered.

"Shear and elastic moduli values were obtained in this investigation by resonant column tests and by others using geophysical techniques. The results of the geophysical tests were provided to us by Burns & Roe, Inc. Elastic moduli values were also obtained by repeated loading triaxial compression tests under both drained and undrained conditions. The moduli determined under undrained conditions were obtained for use in dynamic analyses, while those determined under drained conditions were obtained for use in evaluating settlement estimates under static loads. Those moduli values (E and G) obtained from these tests are summarized as a function of depth in Figs. 020-10 and 020-11. Since each test was performed at different strain levels, the magnitude of the modulus obtained will depend upon the test procedure used and its corresponding strain level. In general, geophysical and resonant column tests are performed at strain levels smaller than would occur during strong motion earthquakes, while repeated loading triaxial tests are performed at higher strain levels. To obtain realistic moduli values which are consistent with the strain levels of interest for earthquakes, adjustments of the test data are necessary. Since the resonant column test values were performed at reduced relative densities and on predominantly sandy samples a somewhat lower modulus was anticipated and obtained than would be expected under actual field conditions. The shaded areas in Figs. 020-10 and 020-11 represent what we believe to be realistic moduli values for design use at the Hanford No. 2 site when considering strain levels corresponding to strong motion earthquakes.

"Also for use in seismic analyses, the damping ratio was measured using resonant column tests and repeated loading triaxial compression tests. Damping values of 1 to 2 percent were obtained from four resonant column tests, while higher values of 7.9 and 9.4 percent were obtained using the repeated loading triaxial test. These data are superimposed at their corresponding strain levels on a summary plot of other published data for sands[1] in Fig. 020-12. From the data shown on this plot, it is evident that the damping ratio is strain dependent, increasing with higher levels of shear strain as suggested by the curves through the data points. These data may be used to guide the selection of soil damping factors appropriate to the shear strains considered for design at the Hanford No. 2 site.

1.5 Groundwater

"In order to obtain groundwater information, observation wells were installed in three of the four corner borings at the plant site. At the northwest corner, a sealed piezometer was installed to determine the hydrostatic pressure in the conglomerate zone of the Ringold Formation. The method used to install the piezometer and observation wells is described in Appendix A-2. During the drilling program, groundwater readings were observed in all of the borings following their completion. A summary of these data is contained in Table 020.4-3. The latest water level readings were taken on May 3 for temporary wells, and May 17 for permanent wells. These readings indicate that the groundwater at the plant site is an average of 62 feet below the ground surface (elevation 378 feet). This depth to water is consistent with other published groundwater contour maps prepared from wells drilled throughout the Hanford area. The piezometer also indicates a water level reasonably close to this average depth.

"Mr. Dave Tillson of Battelle Northwest, states that Well 17-5 located approximately 2 miles north of the site, in his opinion, provides the best indication of the expected seasonal fluctuation in this area. His records on this well show an average annual fluctuation of approximately 1/2 foot, being high in the summer and low in the winter.

2.0 Foundation and Construction Considerations

"The foundation and construction considerations contained in this section are based on the data obtained during the boring program, on laboratory testing and on foundation experience from other structures in the area. This section discusses both the general foundation types and earth pressures that will be required, and also those construction problems relative to foundation and earthwork, that should be considered in preparing the final design. In addition, certain pertinent soil properties for use in the prediction of ground response under earthquake loading have been furnished, though it is understood that these analytical studies will be accomplished by others.

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1 - Seed, H. B. and Idriss, I. M., "Soil Moduli and Damping Factors For Dynamic Response Analyses", Earthquake Engineering Research Center Report No. EERC 70-10, December 1970.

Table 020.4-3

GROUNDWATER OBSERVATIONS

Depth to Water (feet)

Boring No. (Elevation)	B-1 (438.8)	B-2 (437.6)	B-3 (435.2)	B-4 (439.4)	B-5 (438.9)	B-6 (439.2)	B-7 (441.1)	B-8 (440.6)	B-9 (439.8)	B-10 (439.4)
Date 1971										
3/31						Bailed*				
4/2						67				
4/3						64				
4/4						62				
4/5						62				
4/6						62		Bailed*	Bailed*	
4/7						62		63.5	70	
4/12		Bailed*				62.5		64.5	69	
4/13		60				62.2		62.5	69	
4/14		60	Bailed*			62.2		62.5	69	
4/15		60	71			62.2		62.5	68.5	
4/17		60	58	62*		62.2		63	68.5	
4/18		60	59	62		62.2		63	68.5	69*
4/19		60	57.5	61.7		62.2		63	68.0	61.5
4/20		59.5	58	60.8		61.9		62.8	68	61.1
4/21		59.5	57.5	60.8		61.9		62.8	68	61
4/22		59.5	57.5	61.0		61.9		62.8	67.5	61
4/23		59.5	57.5	61.0		61.9		62.8	67.5	61.0
4/26		59.3	57.5	61.0		61.6		62.8	67.7	61.2

* Date boring completed

Table 020.4-3
(Continued)

GROUNDWATER OBSERVATIONS

Depth to Water (feet)

Boring No. (Elevation)	B-1 (438.8)	B-2 (437.6)	B-3 (435.2)	B-4 (439.4)	B-5 (438.9)	B-6 (439.2)	B-7 (441.1)	B-8 (440.6)	B-9 (439.8)	B-10 (439.4)
Date 1971										
4/27		59.5	57.2	61.1		61.5		63.4	67.1	61.2
4/28		59.5	57.5	61.2	Bailed*	61.7		62.3	66.9	61.2
4/29		Pulled	57.2	61.1	63.2	61.5		63.8	66.6	61.0
4/30			57.0	60.9	62.3	61.3		62.3	66.7	61.0
5/1			57.1	61.0	62.2	61.4		62.2	66.7	61.5
5/2			57.2	60.9	62.0	61.5		62.2	66.5	60.9
5/3	Bailed*		57.1	60.9	61.9	61.5		62.3	66.6	60.8
5/4	61.4								66.3	
5/5	60.4		57.2						66.3	
5/6	60.4		56.9						66.5	
5/7	59.9		57.2						66.5	
5/8	60.2		57.2				Bailed*		66.3	
5/10	60.1		57.1				65.2		65.9	
5/11	60.1		57.0				62.5		65.9	
5/12	60.1		57.0				62.3		65.9	
5/13	60.0		57.2				62.5		66.0	
5/14	60.0		57.2				62.6		66.0	
5/17	60.1		57.1				62.5		65.8	

* Date boring completed

"The conclusions and recommendations contained herein are based on data from ten borings (B-1 through 10). Not all of these borings fall within the present limits of the central plant facilities because the entire central complex has been relocated several hundred feet to the south since the completion of the boring program. However, because of the near ideal site conditions, encountered in the borings, we believe this investigation provides the information necessary for final design of the structures discussed herein, recognizing that additional borings will be necessary to verify the anticipated consistency of the subsurface materials at the final locations of the various plant structures. In general, we believe the depositional nature of these soils is such that the consistency in a lateral direction is not likely to change significantly from the results presented in this report.

2.1 Foundation Types and Bearing Pressures

"Based on the proposed design loads for the various structures (as summarized in Table 020.4-4), the reactor, turbine generator and radwaste buildings should be founded on either large spread footings or mat type foundations. Because of their narrow configuration and light loads, the diesel generator building and truck lock are best suited for strip wall footings, while the larger service building can most efficiently utilize spread footings. As presently designed, all buildings in the central plant area, except for the reactor building, will be founded 3.5 to 11.0 feet below the present ground surface, and bear either partially in structural fill or in the medium to dense sands identified in the borings. The reactor building will extend about 20 feet deeper for a total depth to foundation grade of 31 feet. At this depth the sand deposit was determined to be dense to very dense. We believe the undisturbed soils are sufficiently compact to support the large footing or mat loads imposed by the reactor, turbine generator and radwaste buildings.

"Based on the high relative density of the in situ granular soils the depth to foundation grade, and the proposed use of mat foundations, it was calculated that for these three structures the allowable bearing pressure, with respect to a possible bearing capacity failure, would exceed 50 tons per square foot. Consequently, we would conclude that bearing capacity for such foundations will not be the controlling factor in the foundation design, but rather, the settlements which the structures may undergo.

"The service building, because of its wide column spacing and relatively light loads, is best suited for support by spread footings placed within the undisturbed sands encountered at the proposed grade (Elev. 436.5 feet). For the proposed 3.5-foot depth of burial, the allowable static design pressure (factor of safety = 3 against bearing capacity failure) should not exceed 3.5 tsf. The minimum width for spread footings should be 2.5 feet. If the depth of burial is increased to 5 feet, the allowable design pressure may be increased to 5 tsf for the same factor of safety.

Table 020.4-4

SUMMARY OF BUILDING

LOADS AND FOUNDATION CRITERIA

Building	Length (ft.)	Width (ft.)	Bearing Elev. (MSL)	Estimated Area Load DL + LL (tsf)	Assumed Foundation Type
Reactor Building	140	130	409	4.5	Mat
Turbine-Generator Bldg.	304	184	432.5	2.0	Mat
Radwaste Building	218	184	429	2.75	Mat
Service Building	280	80	436.5	3.0*	Spread Footing
Diesel Generator Building	124	60	436.5	2.5*	Strip
Truck Lock	166	32	436.5	2.5*	Strip

Note: Specific information on other structures was not available prior to the submittal of this report.

* Footing stress

Table 020.4-5

SUMMARY OF BUILDING SETTLEMENTS[1]

Building	Area Loading (DL+LL tsf)	Maximum[2] Total	Maximum Differential	Max. Post Construction[3]	Maximum Diff. Post Construction[3]
Reactor Building	4.5	2.1	0.8	0.5	0.2
Turbine Generator Bldg.	2.0	1.4	0.9	0.35	0.22
Radwaste Building	2.75	1.7	1.0	0.4	0.25
Service Building	3.0	1.8	1.1	0.45	0.28
Diesel Generator Bldg.	2.5[4]	0.8	0.7	0.2	0.17
Truck Lock	2.5[4]	0.7	0.2	0.17	0.05

[1]Settlements based on an elastic analysis using estimated foundation loads furnished by Burns and Roe, Inc., and the moduli values presented in Table 020.4-6.

[2]Maximum settlement from time of finished excavation to completion and occupancy of completed structures.

[3]Based on 75% of settlement occurring during construction.

[4]Footing stress.

"Unless extensive shoring is used to support the reactor building excavation, it will be necessary to remove much of the natural ground needed to support the diesel generator building and portions of other surrounding buildings. Because of this, it is recommended that the soil beneath the diesel generator area be removed to about 410 feet and then replaced by compacted structural fill up to final grade. Due largely to their shallow depth, and narrow width, the wall footings for this building and the truck lock must be designed for lower loads than permitted for the deeper and larger mat foundations. The minimum width of these footings should not be less than 2 feet. For a 2-foot depth of burial, the allowable static design pressure (F.S. = 3 against bearing capacity failure) should not exceed 3 tsf. For a 5-foot depth of burial, the allowable design pressure may be increased to 5 tsf.

"To provide safe, temporary slopes around the reactor building, a considerable amount of excavation and subsequent backfilling will be required. As a result, portions of the surrounding buildings will bear in highly compacted structural fill.

"The bearing capacity, in our opinion, will not be significantly reduced if at some future date the groundwater table should rise to within a few feet of the ground surface, due to the construction of Ben Franklin Dam, or some other cause. Others have calculated that with a maximum reservoir pool level of Elev. 400 feet, the groundwater level at the Hanford No. 2 site would rise to within 20 feet of the ground surface (Elevation 420 feet). This situation should be considered in design as long as there is a possibility of this occurrence within the 40-year design life of the Hanford No. 2 Plant.

"One other critical factor regarding foundation support that must be considered in the design of nuclear power plants founded on granular soils, is liquefaction of the bearing soils. Based on the existing site conditions (deep water table and dense, granular soils), in our opinion, there is no potential for liquefaction at the proposed Hanford Plant. Since there is a possibility that the water table could rise some 40 feet or more in the future, we have also considered this potential condition by evaluating the in situ relative densities of the soils underlying the plant. The summary plot of penetration test values and corresponding relative densities using the modified Gibbs and Holtz correlation (Fig. 020-7) demonstrates that below a depth of 40 feet, relative densities approaching 100 percent are not unrealistic, while between 25 and 40 feet, minimum relative densities on the order of 85 percent are present. Above 25 feet, the median relative densities exceed 90 percent. Based on the high relative densities and assuming that the placement of structural fill is adequately controlled, we believe there will be no problem of liquefaction at this site, even under the hypothetical high water case cited.

2.2 Settlements

"Potential settlements have been computed for each of the major structures. These settlements were determined using an elastic analysis where all of the structural loads (DL+LL) were considered to act at their respective foundation grades, as uniform area loads for mat and spread footing foundations, and as individual strip loads beneath wall footings. These analyses were based on the estimated building loads as furnished by Burns and Roe, Inc., and the following elastic moduli.

Table 020.4-6

SUMMARY OF ELASTIC MODULI VALUES

Depth Range*	Avg. Modulus	Soil Type
0 - 40'	25,000 psi	Dense SAND
40' - 107'	60,000 psi	V. Dense SAND & GRAVEL
107' - 217'	90,000 psi	V. Dense Sand & Gravel CONGLOMERATE
217' - 420'	90,000 psi	Interbedded SAND, SILT, CLAY & GRAVEL

*Note: See Fig. 020-9 for generalized soil profile.

These average values for the major soil zones were selected based on the general trend of modulus values obtained from drained triaxial tests as shown in Fig. 020-10. These values represent at best a conservative evaluation of the moduli and, in fact, are probably on the low side since it is not possible to fully recreate the in situ density conditions using small scale laboratory test methods.

"What is described herein (and summarized in Table 020.4-5) as settlement, for the most part will be elastic recompression of the soils below the bottom of the excavation. Since the majority of the total and differential settlement is likely to occur elastically during construction (i.e., during the application of dead loads), post-construction settlements represent only that percentage of the maximum total or differential settlements (Table 020.4-5, Columns 1 and 2) due largely to the application of live loads. It is our understanding that for other nuclear power facilities, the live loads have generally averaged only 10 to 15 percent of the total load, with a maximum of 25 percent. The post-construction settlements presented in Table 020.4-5 (Columns 3 and 4) are based on an assumed 25 percent live load and thus represent the maximum expected values.

"Because of the dense nature of the foundation soils at the project site, fluctuation of the water table, in our opinion, is not likely to significantly affect the predicted settlements, although a rise in water table reduces the effective confining pressure of the soil and thus the effective modulus. The magnitude of this change, in our opinion, is negligible when considering the high lateral stresses that must be present between the soil grains due to the previous preload of approximately 360 feet of soil, which once overlaid this site.

2.3 Positioning of Facilities

"Because the soils in the vicinity of this site were deposited and subsequently eroded under the same geological environment, their density, texture and gradation as a function of depth are generally found to be remarkably similar with only minor local variations. Because of the lateral uniformity of the supporting soils, we believe there is little or no advantage in shifting or repositioning any of the proposed structures on the site because of foundation considerations.

2.4 Excavation

"Excavation for the reactor building will extend 31 feet below the present ground surface, while the other buildings will be founded in the upper 11 feet of soil. All of these excavations will remain well above the water table; therefore, dry conditions should prevail during construction.

"Earthwork for all excavations should be possible using conventional earth excavation equipment. Even though the sands and gravels are very dense with depth, they are generally uncemented; therefore, they should be relatively easy to excavate. No ripping should be necessary. Because of the dry climatic conditions and the relatively clean nature of the materials, construction equipment should be able to work the year round without interruption, except for occasional, severe dust storms. To improve working conditions during construction, it would be desirable to place excavated materials downwind of the construction site.

"The safety of side slopes into the various excavations generally depends indirectly upon the density of the soils. As a preliminary estimate, temporary slopes no steeper than 1.5 horizontal to 1 vertical (1.5:1) should remain stable during plant construction; however, local ravelling resulting from vibration, drying and wind erosion should be anticipated. Ravelling, if found to be excessive, can be controlled or prevented either by flattening the side slopes, occasionally wetting the slopes, or by spraying the slope with one of several commercially available chemicals which provide a thin protective film or crust over the surface.

2.5 Drainage

"Because of the rather dry climatic conditions in the Hanford area, we do not anticipate any significant problems in regard to drainage. Also, since there is very little annual groundwater fluctuation, and because the deepest facility is located some 30 feet above the water table, we expect that there will be no water problems.

"One possibility which should be considered, however, is the effect of a significant water table rise (possibly to an elevation of 420 feet) due to the construction of Ben Franklin Dam. Under this condition, drainage or waterproofing measures must be taken for the reactor building. The other facilities are all well above this level and therefore should be unaffected by this potentially changing condition.

"The waterproofing system for the reactor building substructure should be designed to resist a hydrostatic uplift pressure equal to 62.4 pounds per square foot for each foot that the water level is expected to rise above the lowest floor level. Based on presently available information, the reactor building should have sufficient dead load per unit area to overcome buoyancy due to the maximum possible uplift pressure.

"As an alternate to waterproofing, an extensive drainage system possibly could be designed and constructed to permanently maintain dry conditions around the reactor building. However, this approach is less practical since drainage facilities generally are more suited to those cases where the quantity of seepage is small enough to permit removal of water at a low expense, usually by gravity flow. The potential conditions at the Hanford No. 2 site (i.e., high water table, soils with high permeabilities and groundwater flow) would require a very extensive drainage system and high capacity pumping equipment to remove the water and discharge it from the plant area. The extra cost of maintaining such a dewatering system, which may never be used, in our opinion, makes a waterproofing system much more practical.

2.6 Material Resources

"The granular glacio-fluvial deposits (consisting primarily of clean sand and gravel mixtures), located beneath the proposed site and in various borrow pits throughout the Reservation, provide an abundant source of suitable fill material. Based on grain size curves, water content determinations and compaction tests, most of the soils to be excavated during the initial stage of site grading and building construction should be, in our opinion, suitable for use as structural fill. To use the excavated site materials, a minimal amount of screening or possibly washing may be required to remove large cobbles or excessive amounts of fines. As an alternate, more uniform deposits of sand and gravel probably exist in other nearby borrow pits. The glacio-fluvial deposits found throughout the Hanford Reservation likewise should provide an abundant source of aggregate for concrete.

"The fine surface sands, located in the upper 2 to 3 feet at the proposed site, are unsatisfactory for use in building structural fills or for backfill. However, these sands are probably suitable for use in random fills, though exposed surfaces will be susceptible to wind erosion.

2.7 Structural Fill and Compaction

"To ensure proper drainage and satisfactory compaction, structural fills should consist of well graded, inorganic, sand and gravel mixtures which are free of boulders and cobbles over 3 inches in diameter and contain no more than 10 percent fine grained, non-plastic materials (passing a 200 mesh sieve). Most of the material to be excavated at the plant site satisfies this requirement. In some cases, a slightly higher percentage of fines (more than 10 percent) may be tolerable since those fines observed to be present in the samples from the various borings are essentially non-plastic. Also, the on-site materials are, in most cases, dry of optimum such that they should be easily worked under the dry climatic conditions existing in this area.

"Structural fill and/or backfill which will support building loads, should be placed in 6 to 8-inch lifts and systematically compacted using heavy vibratory rollers. Each lift should be compacted to a minimum of 75 percent of its relative density and with an average relative density of no less than 85 percent. To assure that proper field control of filling operations is maintained, a qualified inspector or soil engineer should be present on a full-time basis to check the quality of the fill and its density in a systematic manner. This should also include inspection of fill placement procedures to assure that the structural fill is uniform throughout and contains no loose pockets or zones.

"From two compaction tests (AASHO T180-57) performed on samples of on-site materials, we have determined the maximum dry density to be 125 and 128 pounds per cubic foot with an optimum water content of 8 and 10 percent respectively. Since the on-site materials generally are dry of optimum by about 1 to 5 percent, the addition of water will be required to achieve maximum densities during compaction.

2.8 Lateral Earth Pressures

"All exterior walls extending below the ground surface should be designed to resist lateral earth pressure. The magnitude of this pressure for purposes of design is primarily dependent upon the conditions assumed (i.e., with the water table as presently exists or with the water table at some predicted level on the wall). Earth pressures for these two conditions are summarized in Fig. 020-13. Generally, flexible walls are designed for active earth pressures (K_a), while rigid walls are designed for at-rest pressures (K_o). For design of exterior, subsurface walls of the reactor building, high at-rest pressures ($K_o = 0.8$) are considered necessary for those walls extending below elevation 432, since backfill in these areas must be densely compacted to support high footing and mat loads of surrounding buildings. Where walls will not be subjected to adjacent footing or mat loads, a lower coefficient of earth pressure ($K_o = 0.5$) may be used, as the degree of compaction need not be as high.

"Also noted in Fig. 020-13 are criteria for determining earth pressures using a coefficient of passive earth pressure ($K_p = 8.5$) and a coefficient of active earth pressure ($K_a = 0.28$). These values were determined assuming the surrounding granular soils will have an internal friction angle (ϕ) of 36 degrees, an angle of wall friction equal to 2/3 ϕ and a log spiral failure surface (in the case of passive pressure).

2.9 Additional Explorations and Studies

"Since the original nine borings (B-1 through B-9) were laid out on a grid system prior to final building location, the borings do not coincide with the present layout of structures in the central plant area. Though the soil conditions underlying the plant site appear to be uniformly very competent across the site and the presently available data sufficient for final design, additional explorations, in our opinion, are necessary prior to the start of construction to verify the competency of the subsurface materials at certain locations within the central plant area.

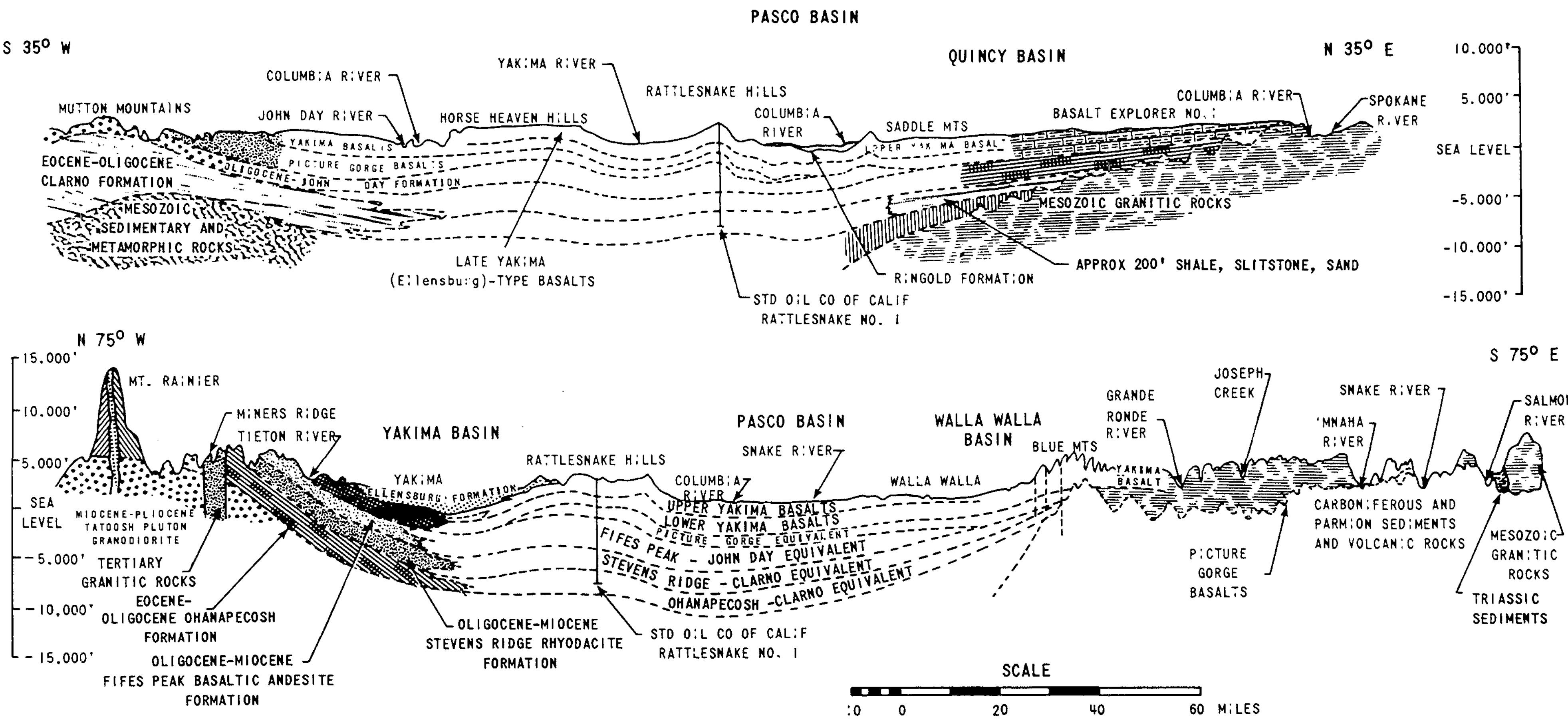
"In addition, we believe the foundations for the other structures and appurtenant facilities such as: cooling towers, office buildings, parking areas, roads, railroads, rail loading docks, transmission towers, switch yard, etc., at other locations around the site should also be investigated. Many of these lighter weight structures, which presumably will be founded near the ground surface, probably can be adequately investigated with backhoe test pits and a few relatively shallow borings. A minimal laboratory testing program also will be necessary to supplement the tests performed to date.

"In addition to liquefaction, there are a number of other natural phenomena which should be evaluated during final design but which were not included in the scope of this investigation. In part, these would include such things as: flooding (possibly caused by the failure of an upstream dam), volcanic activity or other geologic events (such as faulting). We understand that these evaluations are being accomplished by others.

WAC 463-12-020(4) - QUALITY OF THE ENVIRONMENT - LAND
(Supp. filing 9/27/71)

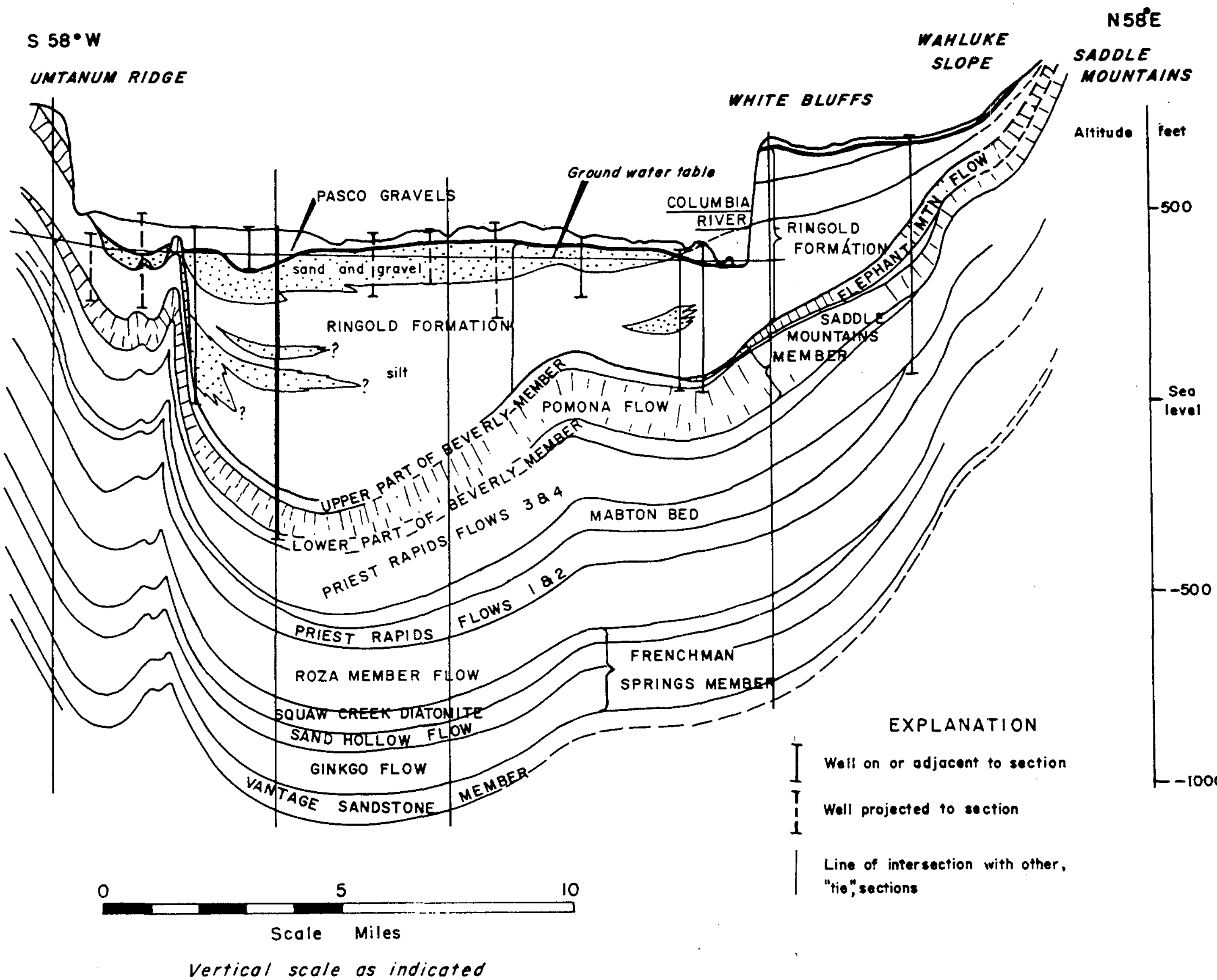
The Applicant has completed a comprehensive geophysical survey to determine the geological conditions of the Site with particular attention to the foundation materials and recorded seismic activity. These studies have verified that foundation conditions at the Site are suitable for the design and construction of the planned facilities.

Pursuant to the provisions of Guideline 463-12-020(4)(b), the Supply System has committed itself to a continuous evaluation of geophysical information during preparation of the Site, including development of the dynamic soil model, earthquake spectrum and further additional geophysical exploration of the specific locations of particular structures of the Project. Ten copies of the May 28, 1971 foundation investigation report prepared by Shannon & Wilson, Inc., Soils Mechanics and Foundation Engineers, Seattle, Washington, have been forwarded to the Council. Upon request, the Supply System will furnish the Council with copies of future reports on geophysical conditions at the Site. This information will also be made available to the Washington State Earthquake Engineering Advisory Council.



Geologic Cross-Sections of Columbia River Basalt Plateau

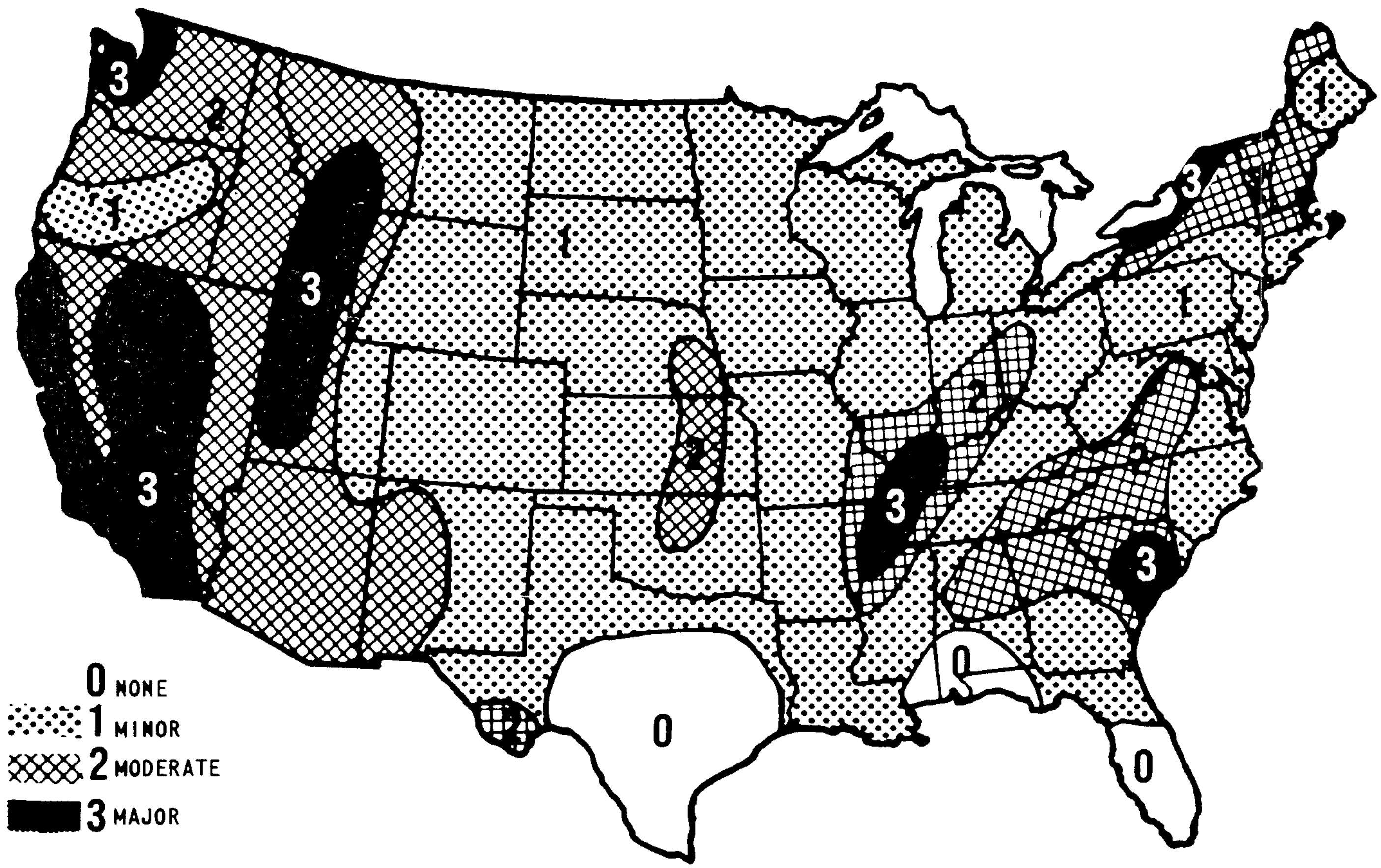
Figure 020-1



A Typical Geologic Cross-Section, from Umtanum Ridge
to East Wahluke Slope

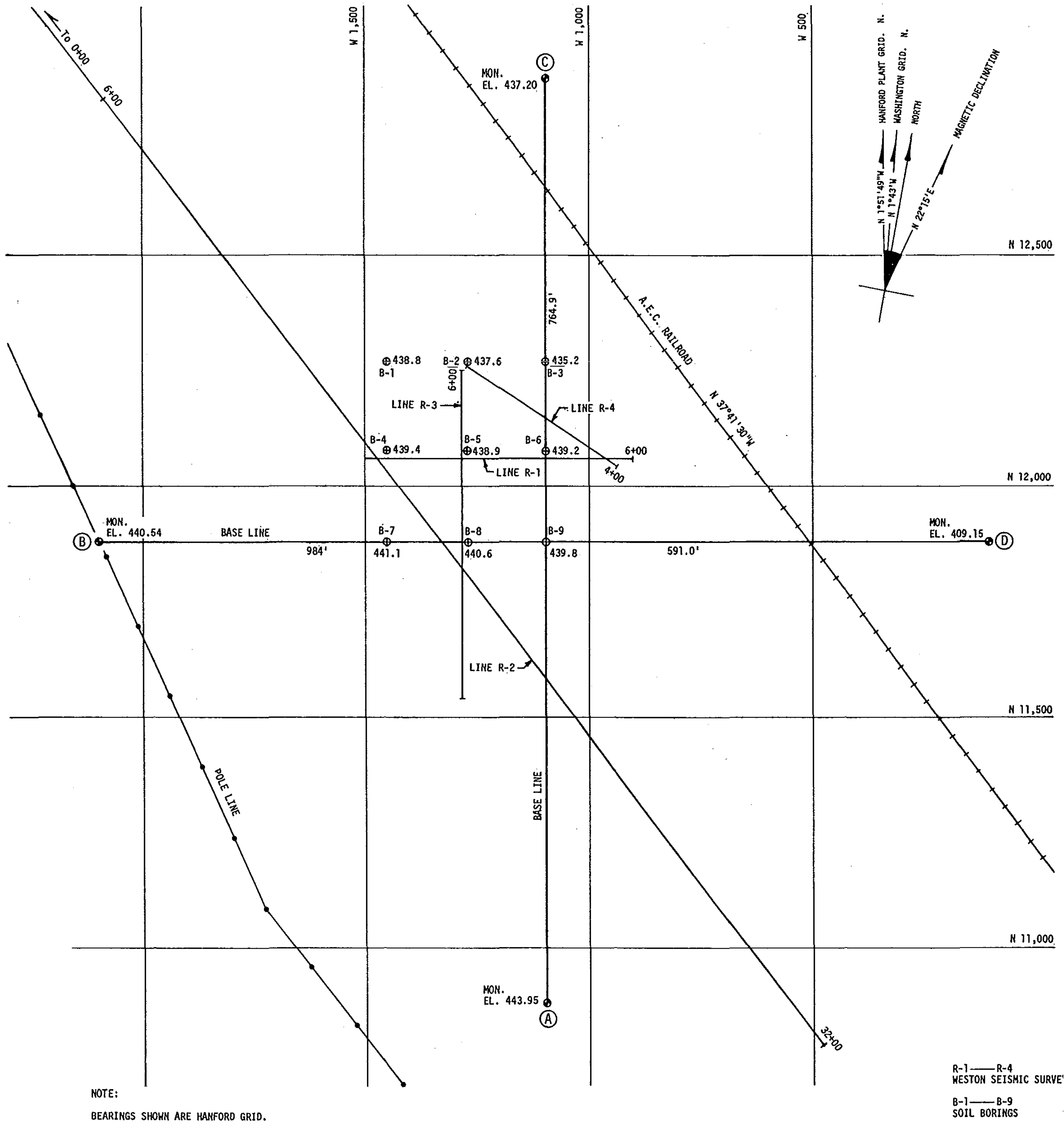
Figure 020-2

SEISMIC RISK MAP FOR CONTERMINOUS U.S.. DEVELOPED BY ESSA/COAST AND GEODETIC SURVEY AND ISSUED IN JANUARY 1969. SUBJECT TO REVISION AS CONTINUING RESEARCH WARRANTS. IT IS AN UPDATED EDITION OF THE MAP FIRST PUBLISHED IN 1948 AND REVISED IN 1951. THE MAP DIVIDES THE U.S. INTO FOUR ZONES: ZONE 0. AREAS WITH NO REASONABLE EXPECTANCY OF EARTHQUAKE DAMAGE: ZONE 1. EXPECTED MINOR DAMAGE: ZONE 2. EXPECTED MODERATE DAMAGE: AND ZONE 3. WHERE MAJOR DESTRUCTIVE EARTHQUAKES MAY OCCUR.



Seismic Risk Map

Figure 020-3

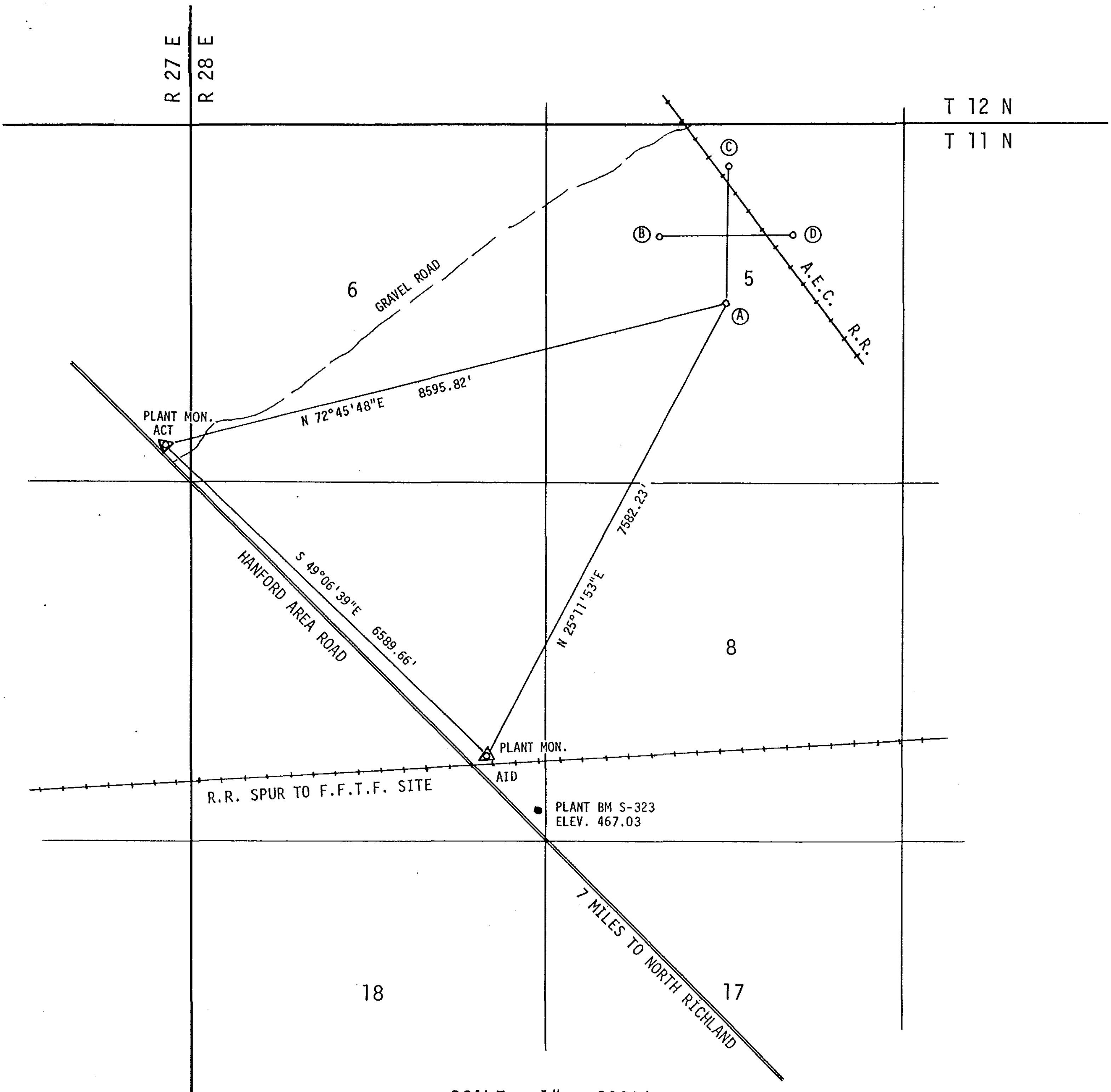


PLOT PLAN

SEISMIC SURVEY AND SOIL BORINGS

Figure 020-4

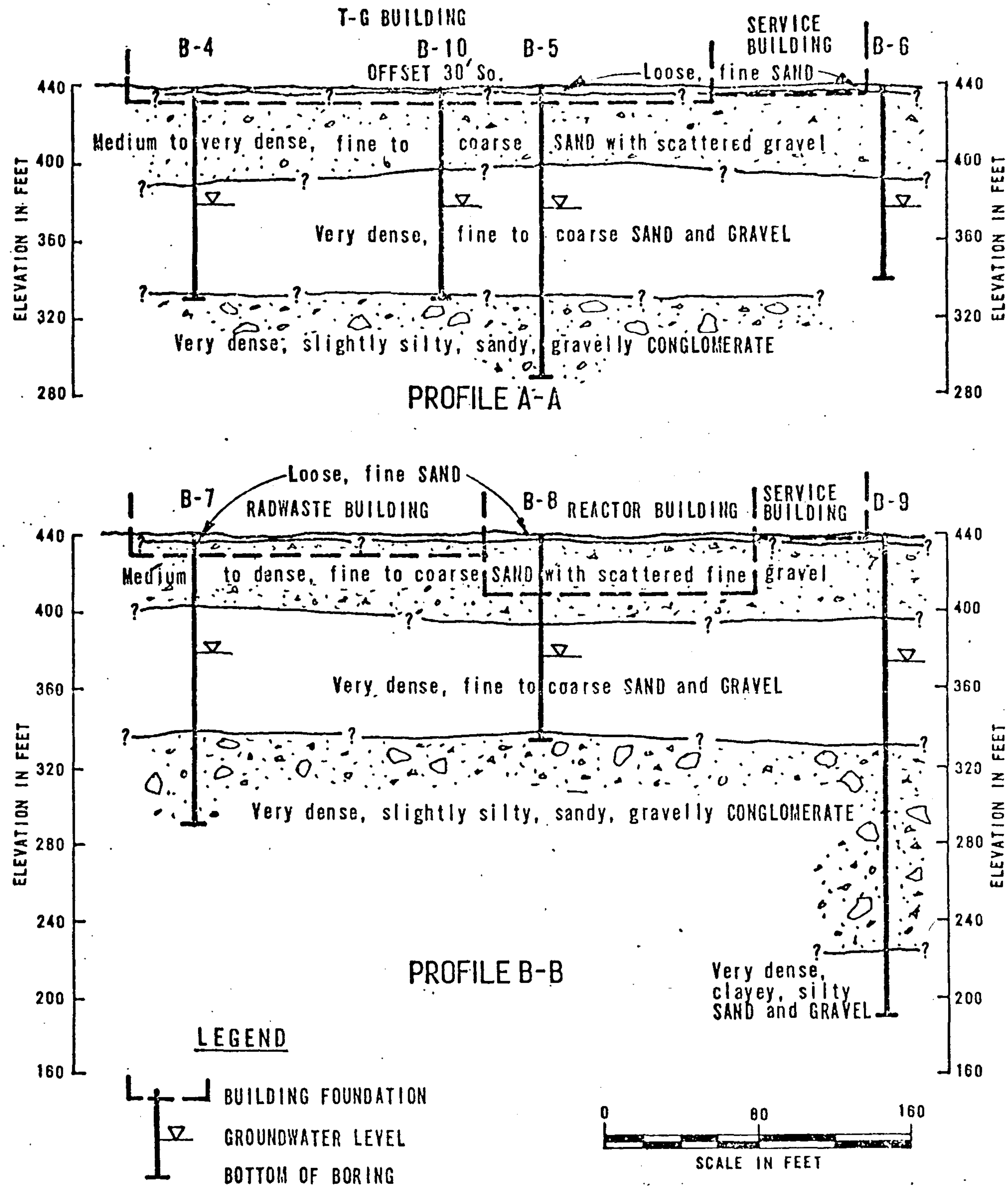
COORDINATES				
PLANT COORDINATES			STATE COORDINATES (SOUTH)	
POINT	N	W	X (E)	Y (N)
A	10,880	1,100	2,294,197.08	416,179.18
B	11,880	2,100	2,293,194.51	417,176.61
C	12,880	1,100	2,294,191.94	418,179.17
D	11,880	100	2,295,194.51	417,181.74
B-1	12,260	1,450	2,293,843.54	417,558.28
B-2	12,260	1,275	2,294,018.54	417,558.73
B-3	12,260	1,100	2,294,193.54	417,559.18
B-4	12,070	1,450	2,293,844.02	417,368.28
B-5	12,070	1,275	2,294,019.02	417,368.73
B-6	12,070	1,100	2,294,194.02	417,369.18
B-7	11,880	1,450	2,293,844.51	417,178.28
B-8	11,880	1,275	2,294,019.51	417,178.73
B-9	11,880	1,100	2,294,194.51	417,179.18



SCALE - 1" = 2000'

LOCATION MAP

Figure 020- 5



NOTES

1. THE PROFILES ARE GENERALIZED FROM THE MATERIALS ENCOUNTERED IN THE BORINGS AND VARIATIONS BETWEEN THE PROFILES AND ACTUAL CONDITIONS MAY EXIST.
2. DATUM: U.S.G.S. MEAN SEA LEVEL.

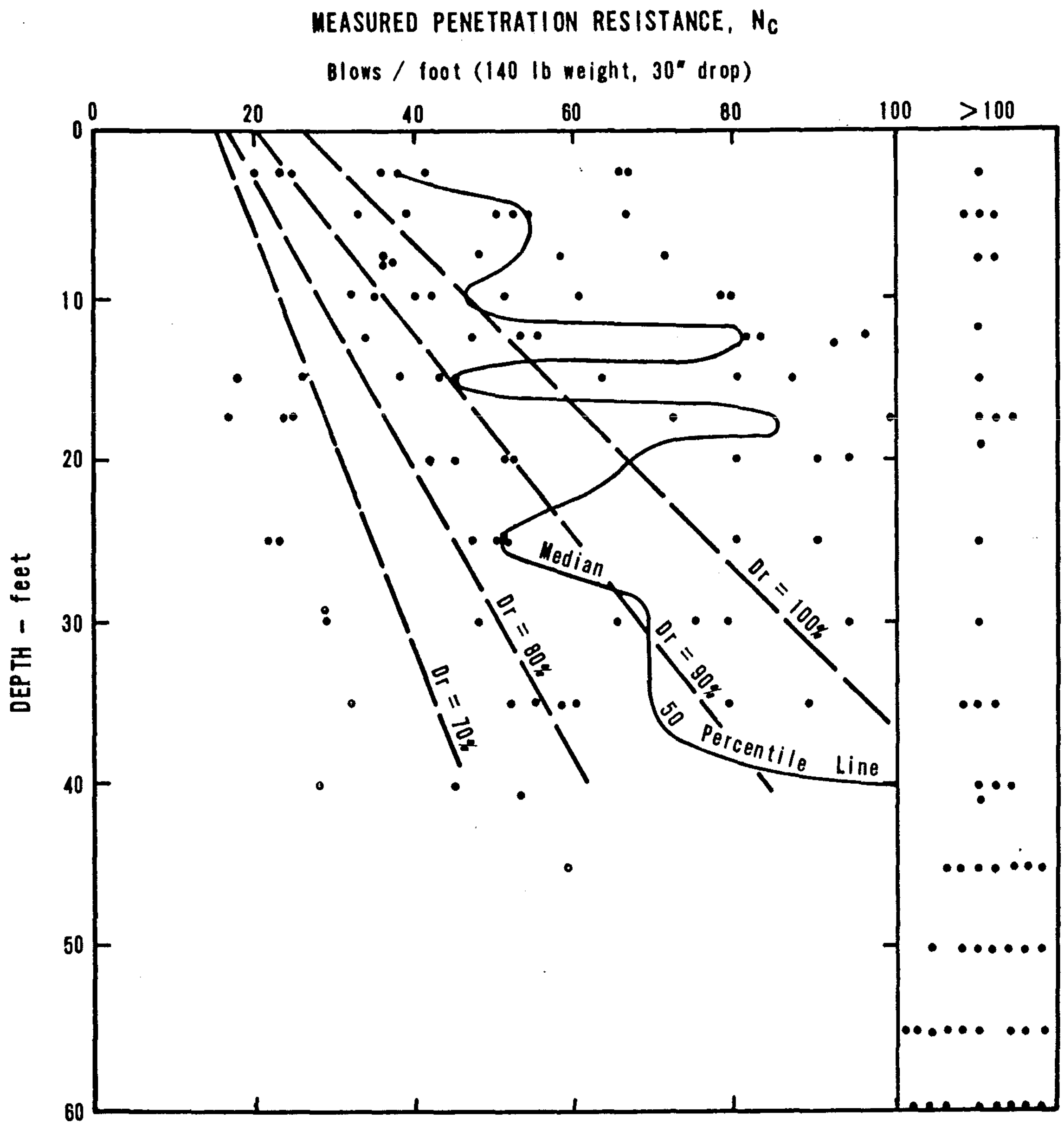
W.P.P.S.S.
HANFORD NO. 2 NUCLEAR PLANT

SUBSURFACE PROFILES

AUGUST 5, 1971 W-2139-01

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

Figure 020-6



NOTES

1. Penetration Resistances obtained from Borings B-1 through B-10.
2. Relative density, Dr, based on Gibbs and Holtz criteria.
3. N_c values were obtained using cable tool drilling methods.
4. Penetration resistance, N_c, was reduced 25% to obtain an 'equivalent' Standard Penetration Resistance (i.e. $N = 0.75\ N_c$).
5. Wet unit weight = 129 pcf.

W.P.P.S.S.

HANFORD NO. 2 NUCLEAR PLANT

2-INCH SPLIT-SPOON SAMPLER

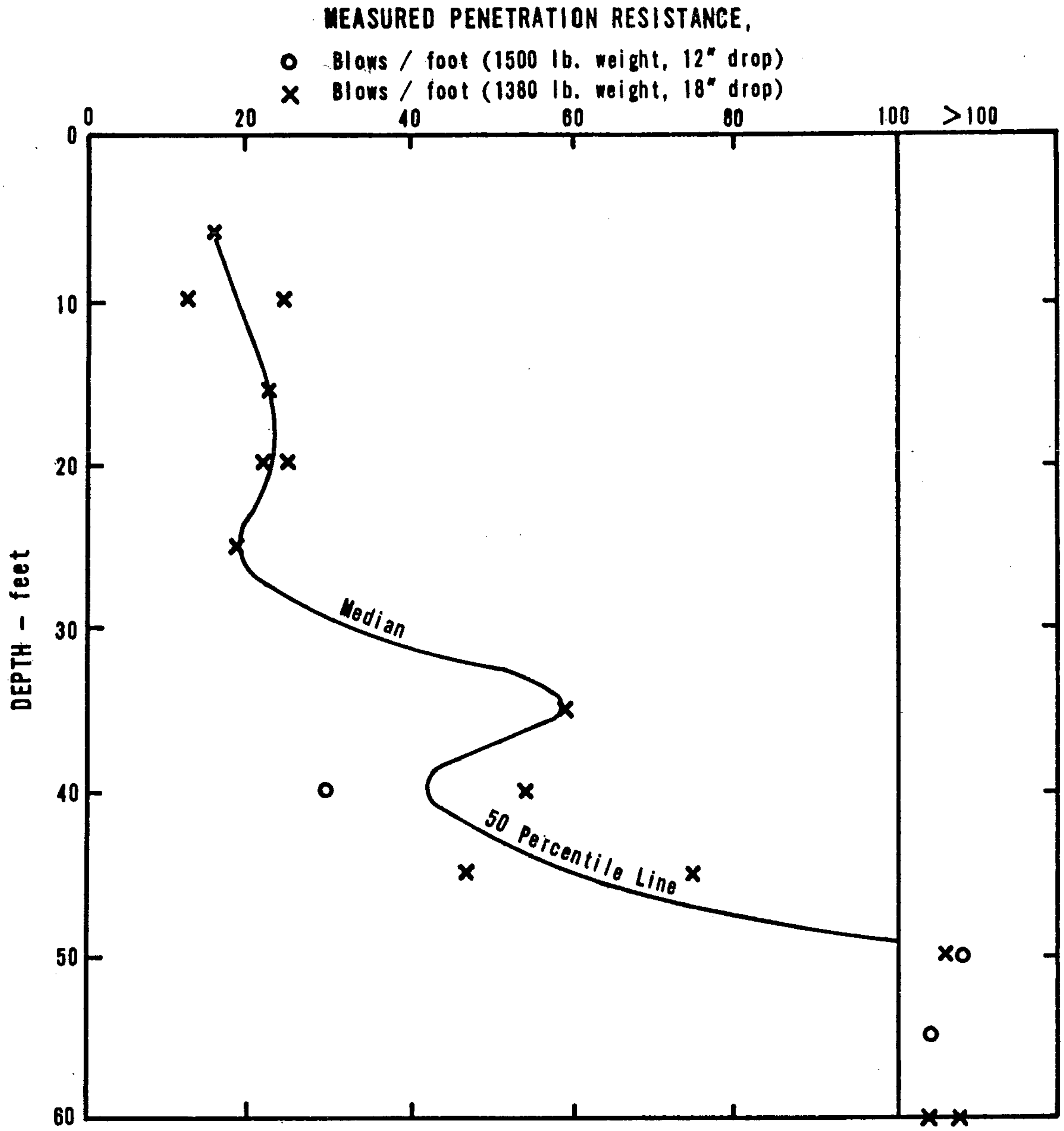
PENETRATION RESISTANCE VS DEPTH

MAY 28, 1971 W-2139-01

SHANNON & WILSON

SOIL MECHANICS & FOUNDATION ENGINEERS

Figure 020-7



NOTES

1. Penetration Resistances obtained from Borings B-1 through B-10.
2. All values measured using 4.5" O.D.(3.5"I.D.) thick wall sampler.

W.P.P.S.S.

HANFORD NO. 2 NUCLEAR PLANT
4.5 - INCH THICK WALL SAMPLER
PENETRATION RESISTANCE VS DEPTH

MAY 28, 1971 W-2139-01

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Figure 020-8

Supp. Filing 8/20/71

DEPTH (feet)	DESCRIPTION	UNIT WEIGHT (wet)	RELATIVE DENSITY	AVERAGE MOISTURE CONTENT
0 – 2	Fine SAND	γ = 115 pcf	Dr = 50%	w = 6 %
2 – 40	Fine to coarse SAND with gravel	γ = 129 pcf	Dr = 85% min.	w = 6 %
40 – 107 (▽ 62)	Silty SAND and GRAVEL	γ = 145 pcf	Dr = 95%	w = 8%
107 – 217	SAND and GRAVEL CONGLOMERATE	γ = 145 pcf	Dr = 100%	w = 12%
217 – 250	Silty, sandy GRAVEL	γ = 145 pcf	Dr = 100%	w = 13%
250	Bottom of deepest boring			
250 – 420±	Interbedded SAND, SILT, CLAY and GRAVEL*	γ = 145 pcf	Dr = 100%	
420±	Approximate top of bedrock			

LEGEND

▽ Water level
γ Unit weight
* Based on data from nearby site (S&W, Inc. files)
Dr Relative density
w Moisture content

NOTE

Average surface elevation 440' (MSL)

W.P.P.S.S.
HANFORD NO. 2 NUCLEAR PLANT

GENERALIZED SOIL PROFILE

MAY 28, 1971 W-2139-01

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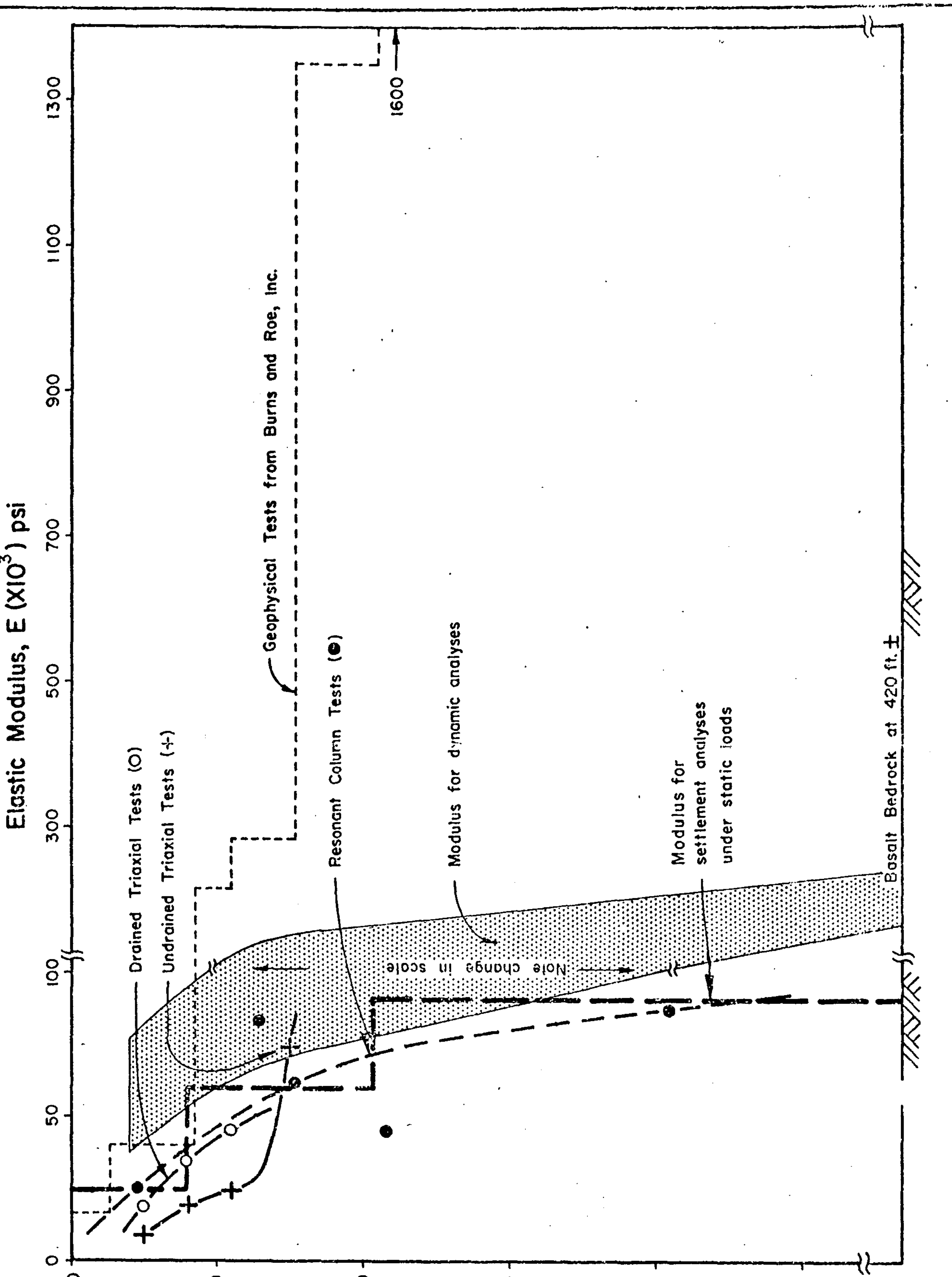
SOIL MECHANICS & FOUNDATION ENGINEERS

Figure 020-9



W. P. P. S. S.
HANFORD NO. 2 NUCLEAR PLANT
SUMMARY OF
ELASTIC MODULUS DATA
MAY 28, 1971 W-2139-01
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SOIL MECHANICS & FOUNDATION ENGINEERS

Figure 020-10

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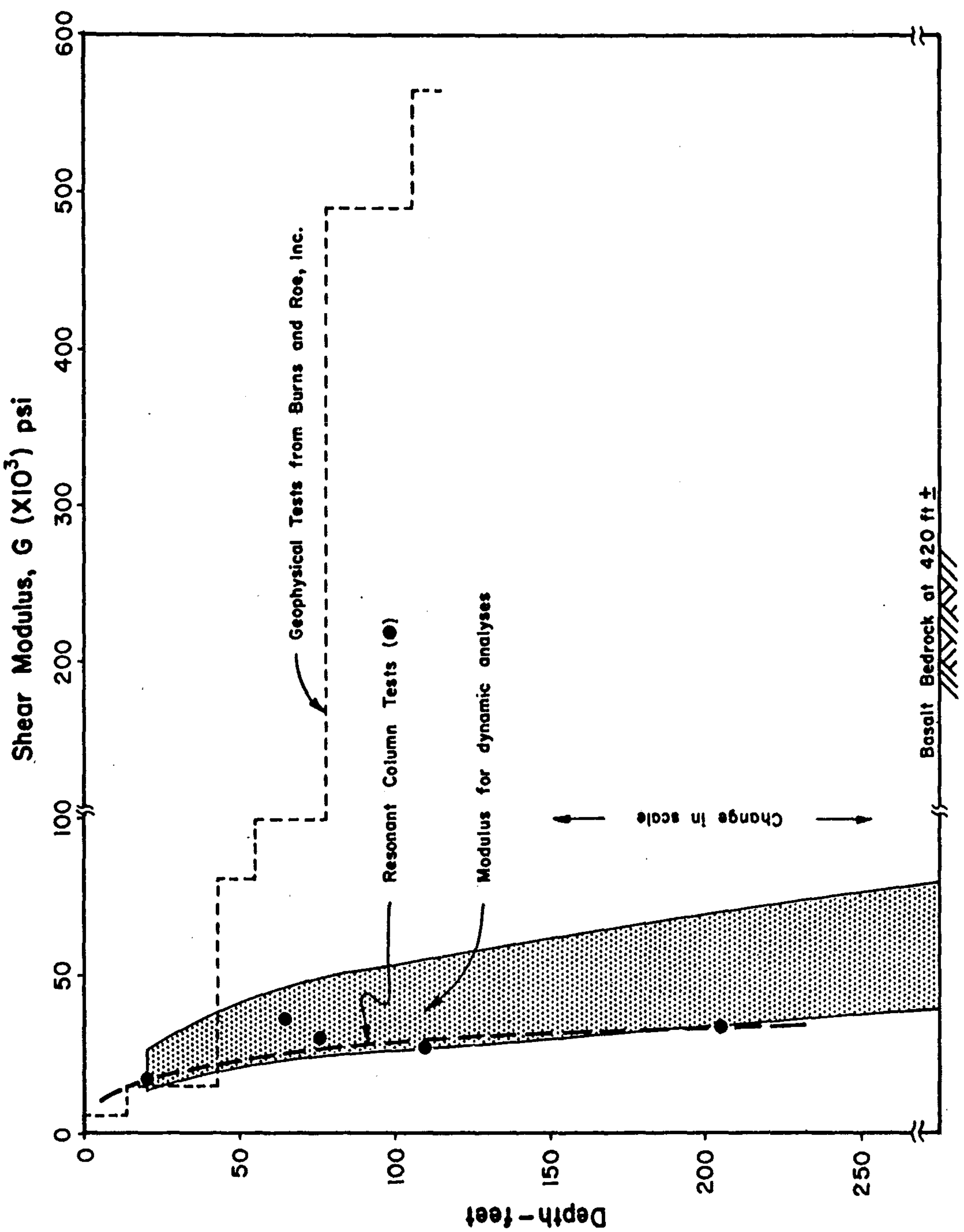

W.P.P.S.S.
HANFORD NO. 2 NUCLEAR PLANT

SUMMARY OF
SHEAR MODULUS DATA

MAY 28, 1971 W-2139-01

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Figure 020-11

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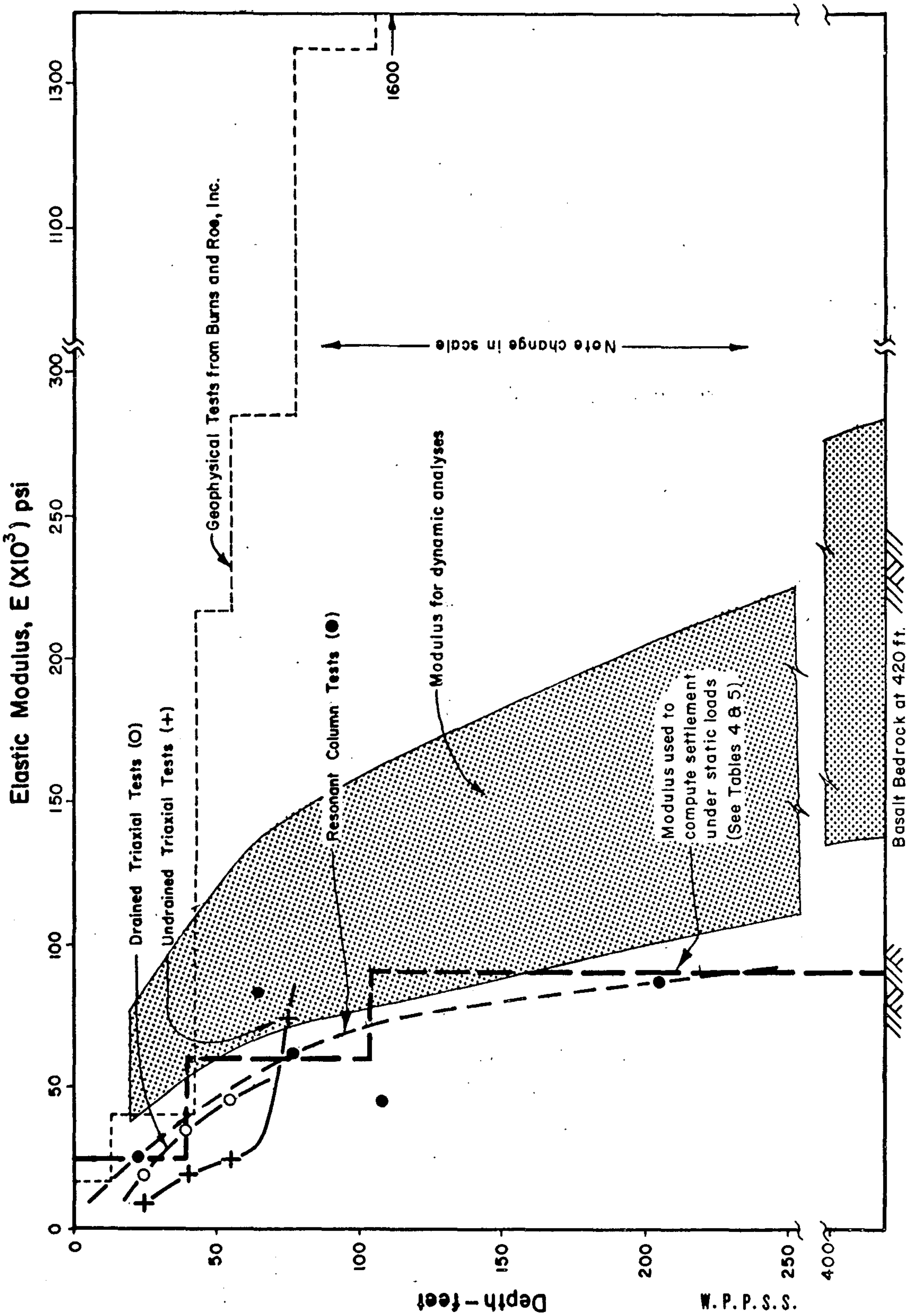
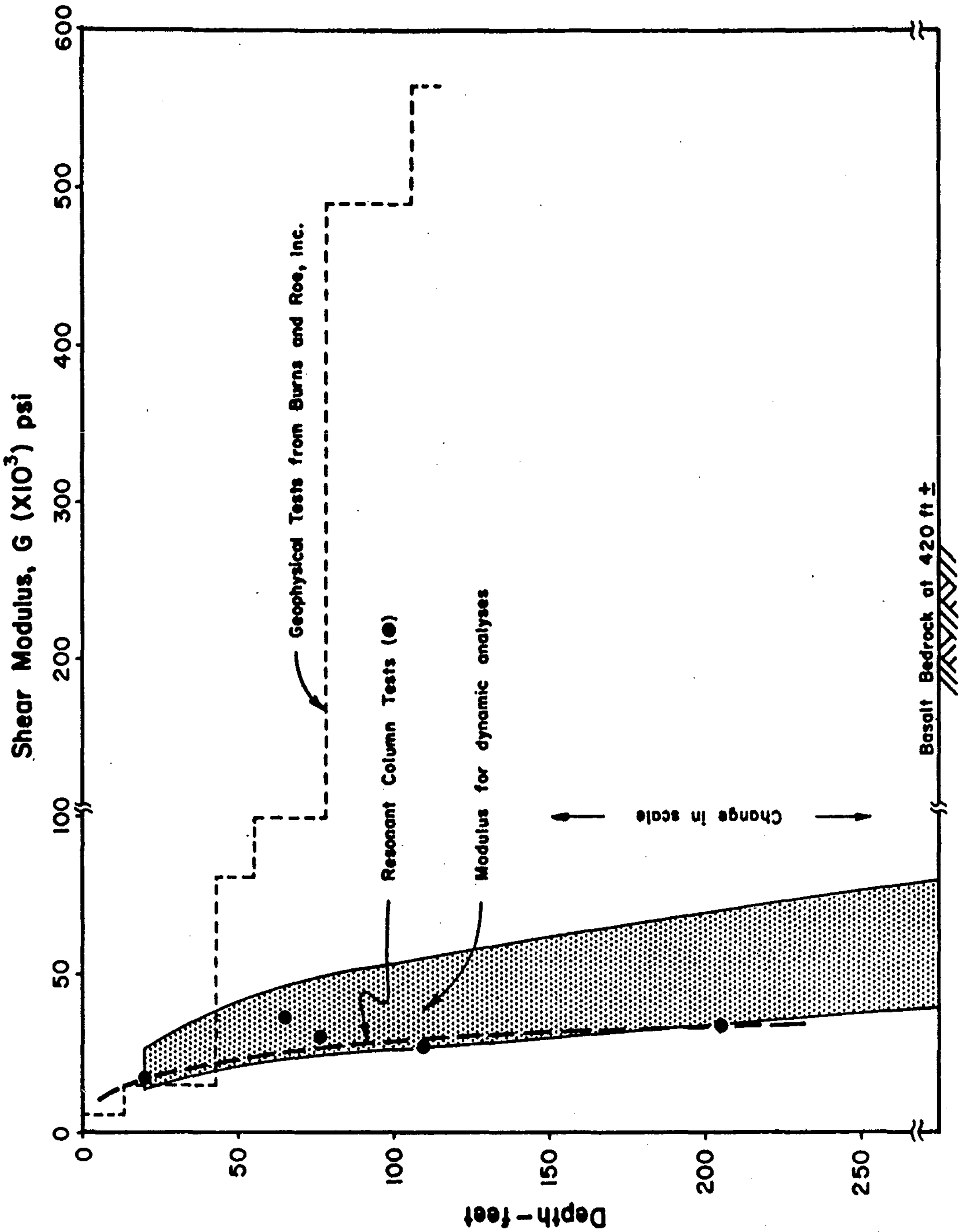


W.P.P.S.S.
HANFORD NO. 2 NUCLEAR PLANT
SUMMARY OF
ELASTIC MODULUS DATA
MAY 28, 1971 W-2139-01
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

Figure 020-10



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HANFORD NO. 2 NUCLEAR PLANT

SUMMARY OF
SHEAR MODULUS DATA

MAY 28, 1971 W-2139-01

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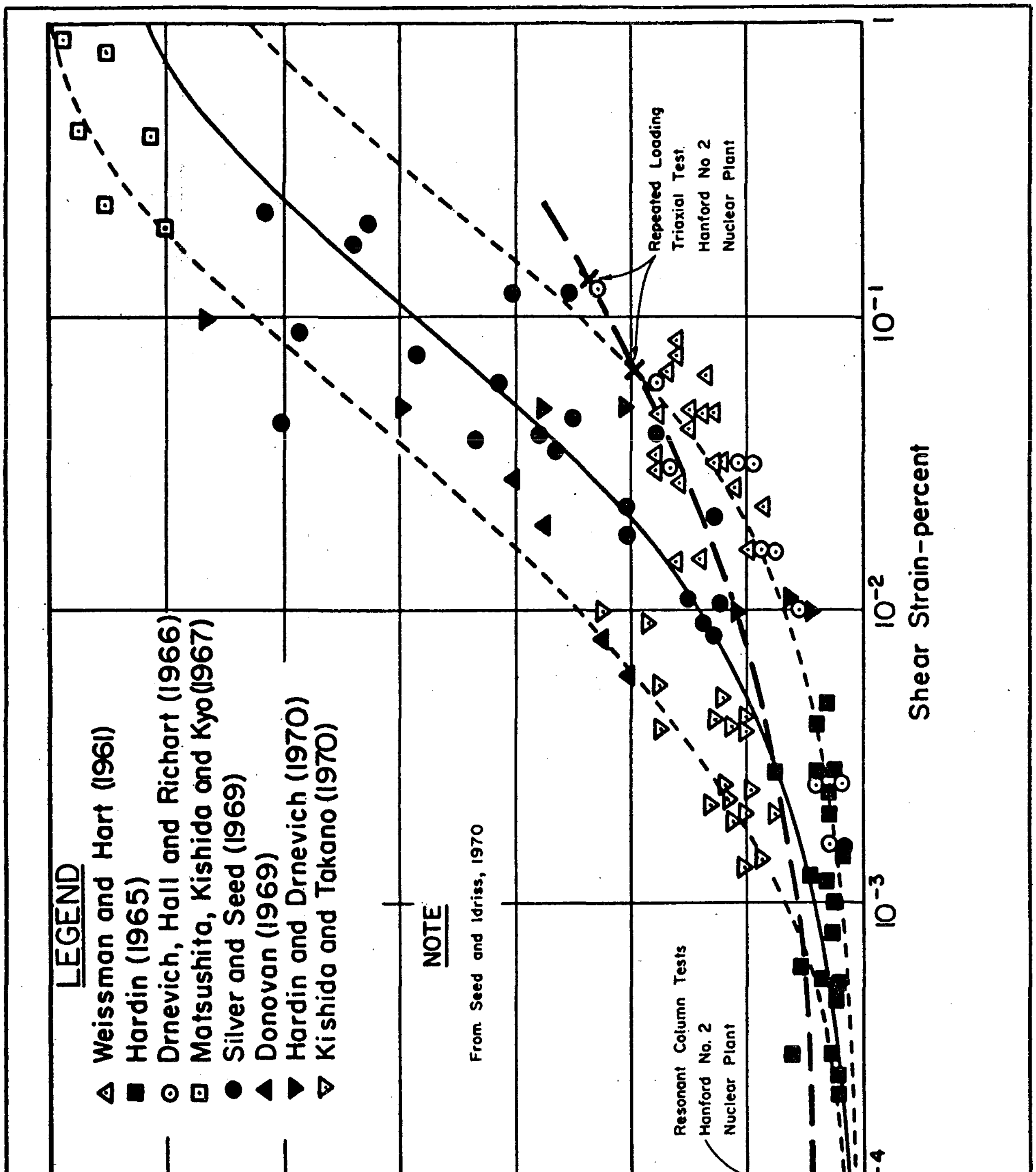
Figure 020-11



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HANFORD NO. 2 NUCLEAR PLANT

SUMMARY OF DAMPING RATIOS FOR SANDS

MAY 28, 1971 W-2139-01

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Figure 020-12

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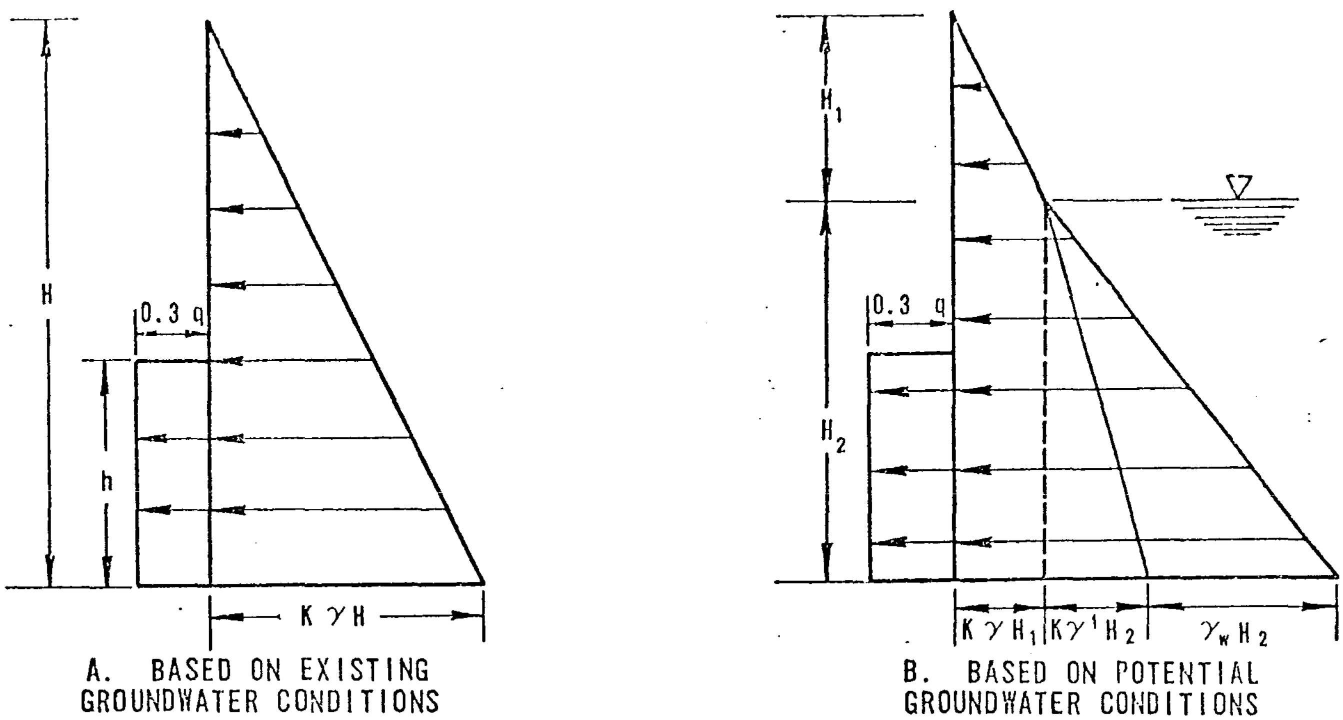

WHERE K = Coefficient of Lateral Earth Pressure
K_0 (at rest)
K_A (active)
K_P (passive)
γ = 130 pcf (moist unit weight)
γ^1 = 68 pcf (buoyant)
γ^w = 62.4 pcf
H = Height of wall or height above or below the water table
∇ = Maximum water level on wall
h = Height between base of wall and any adjacent footing or mat
q = Actual contact stress of adjacent footing or mat foundation.

FOR DESIGN OF BASEMENT WALLS UNDER STATIC LOAD CONDITIONS

USE $K_0 = 0.8$ below elevation 432

$K_0 = 0.5$ above elevation 432

FOR DESIGN OF BASEMENT WALLS TO RESIST PASSIVE EARTH PRESSURES

$K_p = 8.5$ for all walls (Used for computing the maximum passive resistance of the soil)

FOR DESIGN OF FLEXIBLE (YIELDING) WALLS USING ACTIVE EARTH PRESSURES

$K = K_A = 0.28$

Figure 020-13

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W.P.P.S.S.
HANFORD NO. 2 NUCLEAR PLANT

LATERAL EARTH PRESSURES

MAY 28, 1971 W-2139-01

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

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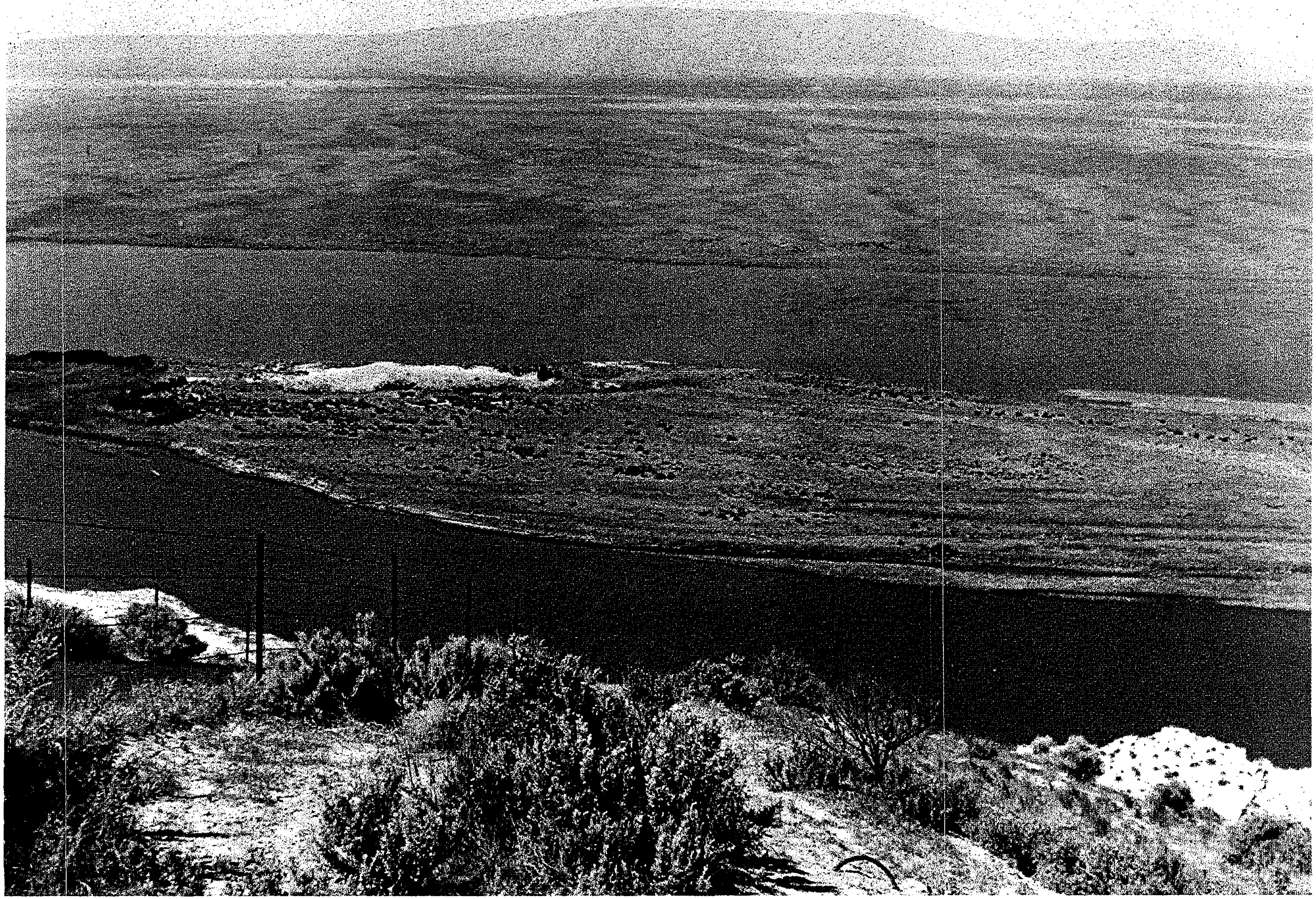


View of Hanford No. 2 Site Looking southwest across the Columbia River from White Bluffs. Rattlesnake Mountain is in the background.

Section 025

Water

<u>WAC 463-12-025</u> - QUALITY OF THE ENVIRONMENT - WATER

(1) Use.

(a) Furnish plant siting plans that are compatible with the State water use programs.

The construction and operation of a conventional nuclear powered electric generating plant utilizing a cooling pond will not interfere with any navigation, recreation, or other uses of the Columbia River.

The proposed Site area is described in Section 010(1a) and is illustrated by Figure 010-2.

The impounded cooling pond exceeding 2000 acres in area will constitute a potential additional resource for possible future use, i.e., aquaculture, refuge and/or recreation.

Heat dissipation from the Hanford No. 2 turbine condensers will be by an evaporative mechanical draft cooling tower system. This evaporative cooling tower system will dissipate the Hanford No. 2 condenser cooling water heat to the atmosphere to avoid thermal impact on the Columbia River.

The mechanical draft cooling tower system is described in Section 025 (2)(b), pages 5 and 6. The layout of the mechanical draft cooling towers is shown on Figure 010-11 "Overall Site Plan" and is also illustrated on the artist's concept contained in Section 040.

Inquiry by the applicant indicates that a definitive "State Water Use Program" is being prepared under HB 394, Chapter 225 Laws of 1971, 1st Extra Session and, as of this filing, the guidelines for this program have not been adopted or issued.

The applicant asserts that the studies, data and information contained in the responses to the TPPSEC guidelines represent detailed conceptual "plant siting plans" which assure compliance with applicable water use programs".

The following is a brief summary of the sections of the application where water treatment, use and quality are discussed:

Section 010 (2) Source and Amount Required
Section 010 (5)(g) State Water Quality Standards
Section 010 (5)(j) Division of Water Resources
Section 010 (5)(n) Board of Natural Resources Right-of-Way Permit
Section 010 (8) Studies
Section 015 (1) Safe Use of Water Areas

Section 015 (3) Background Radiation Data - Water
Section 015 (4) Environmental Monitoring and Sampling
Section 015 (5) Natural Disaster - Flood Protection
Section 020 (1) Water Runoff and Erosion Control
Section 020 (2) Erosion Control
Section 025 Water (entire section)
Section 035 (2)(a) Intake and Discharge
Section 035 (2)(b) Aquatic Life
Section 035 (2)(d) Project Effects - Fish and Other Aquatic Life
Section 045 (1) Recreation - Water Areas

Intake Filtration System

A description of the river intake filtration system to be installed below the bed of the river for Hanford No. 2 makeup water is described in Section 025 (2)(b), pages 2, 3 and 4, and is illustrated by Figures 025-6 and 025-7. This advanced concept of intake facility, which minimizes the effect of withdrawing water from the river and fully protects the fishery, will require further detailed analysis. Supply System consultants will continue to work with the Washington State Department of Fisheries.

Outfall Facility

The cooling tower blowdown water will be returned to the Columbia River. The maximum blowdown rate will be 5,500 gpm with a maximum temperature of 90°F. On occasion, the blowdown water will be about 30° warmer than the river. Compliance with the State of Washington Water Quality Standards discussed in Section 025 (2)(a) and characteristics of the system are discussed in Sections 025 (2)(b) and 025 (2)(c).

The Secretary of the Interior has determined that these standards meet the criteria of Section 10 of the Federal Water Pollution Control Act, as amended. Under these standards the water in the Hanford Reach of the Columbia River is classified

Class A, Excellent, which "exceeds or meets requirements for substantially all uses". A special thermal standard applies to the Columbia River between Washington-Oregon border (River Mile 309) and Priest Rapids Dam (River Mile 397), as follows:

> "No measurable increases shall be permitted within the waters designated which result in water temperature exceeding 68°F nor shall the cumulative total of all such increases arising from non-natural causes be permitted in excess of $t = 110/(T-15)$; for purposes hereof "t" represents the permissive increase and "T" respresents the resulting water temperature."

Chemical discharges are discussed in Section 025 (2)(e).

<u>WAC 463-12-025</u> - QUALITY OF THE ENVIRONMENT - WATER

(1) Use.

(b) Show evidence of consideration of multi-purpose use of cooling water.

The Supply System has discussed possible beneficial by-product uses of project cooling water with federal and state agencies as well as interested private contractors. The Supply System staff will continue to monitor developments in this field concerning possible agricultural, industrial, and recreational aspects of a by-product use of the Project's cooling facilities.

The Supply System is also aware of the AEC restricted water use areas in the Reservation and the surface water discharge limitations that might affect groundwater levels or flow. Some areas would be unaffected by surface water seepage from a cooling pond or other surface water discharge while other areas in the Reservation are restricted or would require additional study.

The design, construction and operation of this Project, which is critical to the power needs of the region, cannot be made contingent upon unknown restrictions and/or successful implementation of a complex unrelated by-product use. In the event that the cooling pond, included as a part of the project facilities, can be adapted to by-product uses the Supply System will cooperate to the maximum practical extent.

On August 6, 1971, Mr. J. J. Stein, Managing Director of the Washington Public Power Supply System in a public statement before the Washington State Joint Legislative Committe on Atomic Energy, meeting in Richland, Washington, stated that water from the Hanford No. 2 cooling tower system, amounting to approximately 4,000 gpm out of the 19,000 gpm required for evaporation make-up, would be available for irrigation. This is sufficient water to irrigate 1,000 acres of land.

As a result of this announcement Mr. Daniel B. Ward, Director, Department of Commerce and Economic Development in a letter dated August 11, 1971, addressed to the Manager, Richland Operations Office, U. S. Atomic Energy Commission outlined the objectives of the State to "acquire, develop and operate land and facilities which will foster the development of the State's nuclear economic potential."

In order to carry out this objective, the Director requested the AEC set aside sufficient land on the Hanford Reservation near Hanford No. 2, or exchange with the State 900 acres of "unsubleased lands"; for the purpose of conducting practical warm water irrigation demonstrations.

In addition to this project the Supply System has received three other proposals for use of the water from the Hanford No. 2 cooling tower system.

Columbia Gardens, Inc., has proposed the construction of ten acres of greenhouses near the plant for the purpose of growing tomatoes. This project would employ approximately 45 people.

The Benton-Franklin Bridge Association is investigating the possibility of utilizing the condenser cooling water for irrigating dry lands north of Pasco in Franklin County. This proposal would involve diverting the Hanford No. 2 condenser cooling water, approximately seven miles to a proposed bridge where the water would be carried across the river and pumped to an irrigation distribution system to be constructed in Franklin County.

Another proposal was received from Mr. Darvin Lambier, 712 W. Bonnie Avenue, Kennewick, Washington who suggests that some of the cooling water from the Hanford No. 2 towers be used to irrigate an area planted in pasture grass to be used for the grazing of cattle.

There may be other uses for Hanford No. 2 condenser cooling water in agriculture and aquaculture. However, the amount of water available for such purposes is limited by the inlet filtration bed size, pumping capacity and pipeline size. The Supply System believes the irrigation proposal suggested by the Washington State Department of Commerce and Economic Development is an appropriate program.

The Supply System desires to fully cooperate and assist in any way it can in the State's proposed irrigation project.

The effect on the groundwater table of utilizing this 4,000 gpm of blowdown under various conditions of location, percolation and evapotranspiration would have to be further investigated by a potential user.

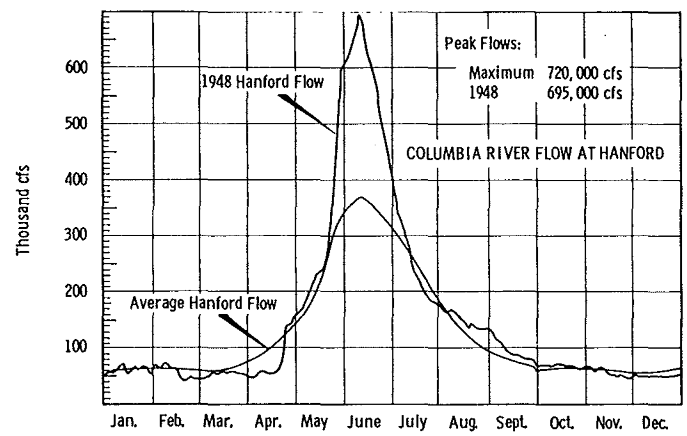
The Supply System in its original statement that it "will continue to monitor developments in this field," was intended to indicate that it would continue to review proposals for the use of Hanford No. 2 cooling water.

(1) Use.

(c) Show by research, studies or other data, that adequate water flow is available to meet total known and future requirements of the plant.

Adequacy of Surface Water

The Columbia River is the controlling water body in the region as a surface water source and its elevation also controls groundwater levels. The surface soils at Hanford are sufficiently permeable to take in water from precipitation and industrial discharges.



The surface water flow of the Columbia River in the Hanford reach is to a large extent controlled by regulation of the upstream reservoir projects which by 1975 will have a total active storage capacity of more than 34 million acre-feet. Some control of flow in the immediate vicinity of the Site (River Mile 350) is experienced from operation of the nearest upstream hydroelectric projects, Priest Rapids Dam at River Mile 397 containing about 45,000 acre-feet of active storage, and Wanapum Dam at River Mile 415 containing about 161,000 acre-feet of active storage. Some minimal effect on the river flow at River Mile 350 is caused by McNary Dam at River Mile 292, approximately 58 river miles downstream from the Site area.

Consumptive use of water upstream from the Hanford reach is primarily associated with irrigation development. The effects of this consumptive use on stream flow has been taken into account in the modified mean monthly discharges for the Columbia River below Priest Rapids Dam shown on Table 025.1c-1. The lowest regulated or modified mean monthly flow is 62,000 cfs. Flows as low as 36,000 cfs (minimum licensed release for Priest Rapids Dam) may be experienced for short periods of time (24-48 hours).

The dependable yield for flows in the Columbia River below Priest Rapids Dam for periods of one year through ten years, as well as the 30 year period 1929-58, is illustrated in Table 025.1c-2. The flow duration curve resulting from a plot of Table 025.1c-2 is illustrated by Figure 025-1. This figure illustrates the percentage of time equalled or exceeded for different amounts of flows below Priest Rapids Dam on a monthly and an annual basis.

The surface water information contained in Table 025.1c-1 is taken from the Columbia North Pacific Region Water Resources, Appendix V, Volume 1, dated March 1969.[1] This preliminary report contains information which includes the Hanford reach of the Columbia River. Table 025.1c-1 and Figure 025-1 are prepared from water records on a fiscal year basis.

TABLE 025.1c-1

Modified Mean Discharges, in CFS, Columbia River below Priest Rapids Dam, Washington

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
1928										224000	109900	90900	
1929	82300	78400	101100	103000	108000	72600	85200	62000	71300	87600	97000	94300	86900
1930	87900	89800	102700	93500	90700	83100	72500	81700	90200	98800	97600	92700	90100
1931	86800	89600	100000	82200	90800	88400	74500	81700	104000	102200	99400	85800	90400
1932	87400	88700	102000	95000	109200	77800	90700	157500	156700	74600	97800	90600	102300
1933	89600	69700	102700	128800	167100	97900	118900	185900	196600	180300	121900	100200	130000
1934	100600	104200	128000	139600	203400	196700	243100	221200	168800	104500	100000	101000	150900
1935	82000	72400	109200	132100	132000	111300	117600	147500	156900	131100	99300	96900	115700
1936	90200	86200	107900	119400	79800	80400	81500	160500	123300	83400	93200	89400	99600
1937	87600	87500	105400	96600	100600	84400	63500	70400	76900	87800	102500	91500	87900
1938	89300	83100	88700	111000	124100	86800	110700	142400	146800	154100	90400	89200	109700
1939	83400	77100	91700	127200	90400	83000	108500	100000	112400	95500	96900	90800	96400
1940	85800	85400	90500	133200	98000	89200	110700	89700	101700	94100	96000	91600	97200
1941	84300	79600	92500	99400	92200	87900	137400	76900	73200	84000	91500	88700	90600
1942	96000	82700	91400	114100	119000	84600	115900	105300	148400	101400	102000	88300	104100
1943	87900	65800	86800	105600	150600	116000	132400	202600	134300	147700	101300	88900	118300
1944	81300	77200	96800	99300	110600	78700	88200	88000	69100	81200	94600	84400	87400
1945	90100	90900	103600	88500	94000	86500	77800	112800	67800	88800	99300	87400	90600
1946	86200	85700	92500	95600	117700	90800	112200	178100	170900	134500	94400	91100	112500
1947	79600	81300	93100	116000	137800	135200	155900	184400	163400	136300	89900	85500	121500
1948	94700	96000	113900	113200	202800	166700	137700	193400	257600	194700	122900	101900	149600
1949	88000	83600	97700	126000	114000	80000	123000	166400	181600	82700	92200	87800	110200
1950	79000	69500	106800	123300	155200	145400	136400	197500	200200	211900	114800	96200	136400
1951	91800	87900	102600	115400	223400	186200	195600	188800	171300	174300	110300	91700	144900
1952	94200	98800	112200	126500	155200	113300	134600	172400	135800	145100	88700	85900	121900
1953	85500	83900	103900	95500	124800	87800	98700	174000	168300	141400	99000	89200	112700
1954	83600	89800	110300	122100	153600	135200	124200	191200	224900	228400	163600	114400	145100
1955	98700	103400	126600	132400	143900	102700	110500	104300	181800	193300	111900	91000	125000
1956	95700	94500	97000	108100	206500	200600	173500	245800	212600	200400	103600	90700	152400
1957	87400	82900	109400	132100	145100	101200	113600	182700	176500	120900	89000	86900	119000
1958	77500	75200	83300	120200	123700	107300	125000	172800	172900				
Mean	87800	84700	101700	113200	132100	108600	119000	147900	147200	132800	102400	91800	114100

TABLE 025.1c-2 Dependable Yield, Columbia River Below Priest Rapids Dam, Washington

Consecutive Years of Lowest Mean Flow	Inclusive Years	Lowest Mean Flow (cfs)	Percent of 1929-58 Mean
1	1937	86,600	75.9
2	1930-31	89,900	78.8
3	1929-31	92,900	81.4
4	1929-32	95,800	84.0
5	1937-41	96,400	84.5
6	1937-42	97,300	85.3
7	1936-42	98,400	86.2
8	1937-44	99,000	86.8
9	1937-45	97,900	85.8
10	1936-45	98,600	86.4
30	1929-58	114,100	100.0

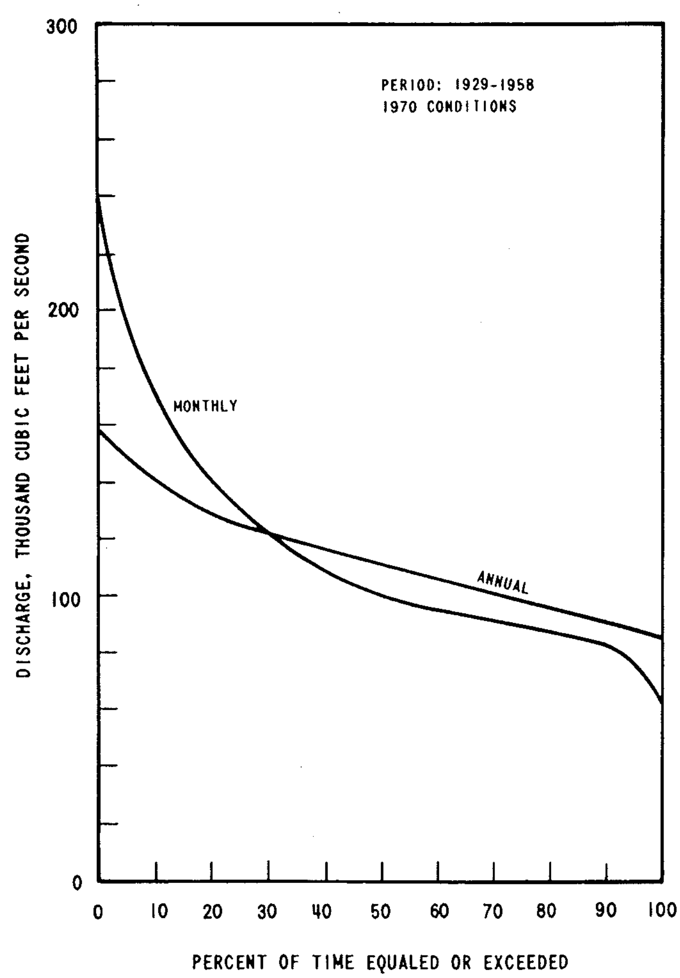
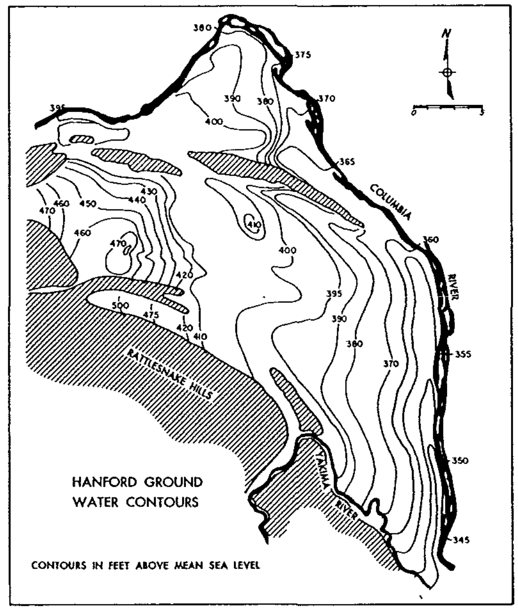


Figure 025-1 Duration Curves, Columbia River Below Priest Rapids Dam

Groundwater

References are contained in the Bibliography of Related Material included at the end of this section (Section 025) concerning groundwater on the Hanford Reservation.



The AEC through its contractors has drilled more than 1500 wells in the Hanford Reservation area and presently monitors approximately 600 wells. Figure 025-2 is a plan view of the well locations in the Hanford Reservation as of approximately January 1969. In addition, AEC monitors approximately 400 additional wells in the surrounding area. In general, the groundwater elevations caused by groundwater flowing under the Reservation are the highest in the southwestern area toward Rattlesnake Mountain and decrease in elevation toward the 200 Areas near the center of the Reservation. From the 200 Areas the general decrease in elevation is northeast and southeast.

A typical Hanford groundwater contour map is shown above. A typical Hanford groundwater contour map based on construction of the proposed Ben Franklin project is illustrated by Figure 025-3.

Groundwater flow beneath the Hanford Reservation has been simulated by a digital computer model based on available geologic and hydrologic data. This model was developed by Battelle Northwest Laboratories under the sponsorship of Atlantic Richfield Hanford Company. The model can simulate a new Hanford water table resulting from new stresses on the groundwater system, and can predict the new flow paths that should result.

SUMMARY OF THE HYDROLOGICAL INVESTIGATIONS * OF THE WPPSS HANFORD NO. 2 BY PACIFIC NORTHWEST LABORATORIES

INTRODUCTION

The Pacific Northwest Laboratories of Battelle conducted a study of the effects of proposed cooling ponds for the Washington Public Power Supply System Nuclear Project #2 on the Hanford groundwater system and issued a final report dated July, 1971. At the request of Burns & Roe, Incorporated, additional studies were conducted to investigate the effect of unlined cooling or blowdown ponds at other site locations.

Mathematical simulation techniques developed previously by Battelle for modeling the Hanford groundwater system were employed in this study. Although the modeling techniques are operational and have been utilized on other studies, the total verification effort has not been completed. This will take approximately another year. The modeling techniques used in this study are significantly advanced over those used in previous years, such as in a study of the effects of Ben Franklin Dam on the Hanford groundwater system.

The research program reported here consisted of the simulation of unlined and lined cooling ponds or blowdown ponds at the C and C_1 Sites, and blowdown ponds at Site B and an area northeast of Site C designated as the sand dunes. Particular attention was given to predicted groundwater rises under existing facilities on the Hanford Reservation. In addition, an analysis was made of initial pond seepage losses as well as the time required to reach equilibrium conditions.

The results of this study have led to the abandonment of the cooling pond concept for Hanford No. 2. The predicted groundwater increases and the potential interference with buried wastes and other facilities has led to the investigation of cooling towers and methods of handling blowdown water that would cause little or no effect on the groundwater.

SUMMARY

The effects of lined and unlined cooling and blowdown ponds on the Hanford groundwater system were investigated at four different locations on the Hanford Reservation.

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* Final Report on Hydrology Studies of the WPPSS Nuclear Project #2 Site, July, 1971.

Addendum I to Final Report on Hydrology Studies of the WPPSS Nuclear Project #2 Site, July, 1971.

The groundwater rises under the 200 Separations Areas were negligible for the lined pond case studies. For the unlined ponds at Site C, the predicted rises beneath 200 East Area were 25, 25 and 25-30 feet for the 1-1/2, 2-1/2, and 3-1/2 square mile ponds, respectively. The predicted rises beneath 200 West Area were between 1 and 9 feet for all unlined pond sizes at Site C. For the unlined, 3-1/2 square mile pond, the added rise in the water table beneath the 200 Areas resulting from the 400-foot pool of the proposed Ben Franklin Dam is negligible. However, additional increases of 10 to 40 feet in water table elevations in the reactor areas (northern portion of the system) were observed resulting from the proposed Ben Franklin Dam.

Three case studies were conducted at the C_1 Site using two pond sizes--3 square mile pond with water levels of 400 and 410 feet, and 1-1/2 square mile pond with a pond level of 410 feet. The predicted water tables were below the bottoms of the key facilities for all three case studies. Rises of 13, 13 and 6 feet will ultimately occur beneath 200 East Area for the 400 foot 3 square mile pond, the 410 foot 3 square mile pond, and 1-1/2 square mile pond, respectively. Rises beneath the 200 West Area would be negligible.

Approximately 7000 gpm of cooling tower blowdown can be discharged at a location north of Site B with negligible effects on facilities south of Gable Mountain. The water table rises beneath 100 Area burial grounds would be small, and the distances between facility bottoms and the predicted water table would be large. The pond area was approximately 1.4×10^6 square feet and the water level was held at 440 feet.

Discharge of cooling tower blowdown in the sand dunes to a pond area held at the 440 foot level would ultimately result in a water table rise of 9 feet in 200 East Area and a negligible rise in 200 West Area. The predicted water table would be below the bottoms of key facilities. The pond area was approximately 2.4×10^7 square feet.

DISCUSSION OF RESULTS

The following sections contain discussions on the effects of unlined ponds on the hydrology of the Hanford Reservation resulting from discharge of cooling tower blowdown at the C Site, the B Site, the Sand Dunes, and from operation of a cooling pond at the C and C_1 Sites. The various cases studied and the results are shown in Table 025.1c-3.

1. Hydrological Evaluations at the C Site

Case studies were conducted to determine the effect of locating a cooling pond or discharging cooling tower blowdown at the C Site. The location selected was a depression just east of the reactor site. For the case studies considered, only the unlined ponds showed any significant groundwater rise under the 200 Areas. For the 3-1/2 square mile pond, the predicted rise beneath 200 East Area ranged between 25 and 30 feet (See Table 025.1c-3) for the 3-1/2 square mile pond with Ben Franklin

Dam, the rises beneath 200 East and 200 West Areas are essentially the same as those which occurred without the presence of the dam. Under 200 West Area, the rise ranged between 1 and 9 feet. For both the 2-1/2 and 1-1/2 square mile ponds, a rise of approximately 25 feet under 200 East Area and rises of between 1 and 9 feet under 200 West Area were predicted. These results supersede the results presented in the preliminary investigations on the effects of cooling ponds on the Hanford groundwater system.

It should be noted that the predicted groundwater rises are considerably more than those predicted in the previous investigation. This difference resulted from restricting the model convergence limits in the previous study. The differences in predicted groundwater rises are not a reflection on the accuracy of either model input or output, but rather an operational problem which has been resolved.

A summary of the water table changes occurring at key facilities is contained in Table 025.1c-3. A large portion of the Wye Burial Ground was shown to be saturated in the three unlined pond case studies. For a 1,000 gpm/square mile loss rate in the 3-1/2 square mile pond, the predicted water table was 16 feet below the burial ground bottom. For all of the other lined pond case studies which had prescribed leakage rates of 1,000 gpm/square mile, the distances between the water table surface and the burial ground bottom were greater than 16 feet.

An additional factor was considered that is particularly important when evaluating a lined or low leakage pond. At low seepage rates, it takes a long time to effect rises in the water table. Time factors are shown for various loss rates in Table 025.1c-4 using the volume of water required to cause the water table rises for the unlined, 3-1/2 square mile pond. It is assumed that none of the seepage water leaves the reservation (an extremely conservative assumption since present travel times are on the order of 20 years). The volume of water is 4.23×10^{10} feet^3.

A second less conservative approach was also pursued to obtain additional insight into the time required to produce water table rises. It was assumed that the flow reaching the river from the east side of the pond during the time of groundwater rise could be estimated by using an average gradient between the present water table and the proposed pond level. The amount of water entering storage is then the difference between the steady pond loss rate and the quantity estimated to be entering the river. Figure 025-8 shows these results for the 3-1/2 mile, unlined pond (10,000 gpm), the 410 ft. held pond (3400 gpm) and a pond with a 4300 gpm loss rate. Under actual conditions, the rises will not be straight lines; however, well hydrographs indicate rather short response times from a few months to a few years showing this technique to be reasonable for the Hanford system.

For the case studies assuming cooling towers, an area of 1.7×10^6 square feet encompassed by 410 feet ground surface contour was chosen for disposal of the blowdown water. Assuming an infiltration capacity of 400,000 gpm/square mile, this area represents four times that required initially to dispose of the blowdown water (6000 gpm). A case study was run to determine the effect of discharging 6000 gpm to that pond area. The water table was predicted to rise above the ground surface at the point of discharge, indicating that the equilibrium loss rate from a pond of that size would be less than 6000 gpm.

A water level of 410 feet was selected for the above pond and the case rerun. The equilibrium loss rate was calculated to be 2700 gpm.

The predicted water table is below the bottom of all key facilities. A water table rise of approximately 8 feet would occur in 200 East Area. Water table rises in 200 West Area are negligible.

Another case study was run at this site for a pond of approximately 3.1×10^6 feet^2 in area. This pond size was obtained by extending the above pond to include all of the 410 foot contours within the depression east of the proposed reactor location at Site C. The equilibrium loss rate was calculated to be 3400 gpm. The water table changes beneath the key facilities are shown in Table 025.1c-3. As with the smaller pond, the predicted water table lies below the bottom of all key facilities. Water table rises of approximately 9 feet would occur beneath 200 East Area. The water table rises beneath the 200 West Areas are negligible.

Based on the results of these investigations, it appears that discharge of appreciable quantities of water to the depression east of Site C will result in a rise in the water table beneath 200 East Area. This can be explained by considering the transmissivity distribution for the Hanford system, Figure 025-9. As can be seen, this depression overlays one of three highly permeable channels that transmits flow from the 200 East Area to the Columbia River. At equilibrium, the unlined ponds block this channel, causing flow from the 200 East Area to be diverted to the two remaining channels. In order to get the flow originating from B and G swamps through these two channels, higher gradients and larger saturated thicknesses are required, which results in water table rises in the 200 East Area. For the lined ponds, a saturated barrier is not formed and the channel is not blocked off. The seepage from the ponds overlays the flow originating in the 200 Areas, instead of blocking it off, and moves eastward to the Columbia River.

2. <u>Hydrological Investigations of Unlined Ponds at Site C_1</u>

Three case studies were conducted at Site C_1 which include a 3 square mile pond with water levels of 400 and 410 feet and 1-1/2 square mile pond with a water level of 410 feet. The changes in the water table beneath the key facilities for these case studies are contained in Table 025.1c-3. It can be seen that the predicted water table is below the bottom of the key facilities for all three case studies. Water table rises of 13, 13 and 6 feet will occur beneath 200 East Area for the 3 square mile pond with a 400 foot water level, the 3 square mile pond with 410 foot water level and 1-1/2 square mile pond, respectively. The rises beneath the 200 West Area are negligible. In general, the water table rises resulting from the 1-1/2 square mile pond were appreciably less than those calculated for 3 square mile cases. This is because the pond location is on the southern tip of the high permeable channel discussed in the previous section.

3. Hydrologic Evaluations of the Discharge of Cooling Tower Blowdown at Site B

A depression encompassed by a 440 foot ground surface contour northeast of Site B was evaluated for possible discharge of cooling tower blowdown. The pond area is approximately 1.4 x 10^6 feet^2 and its location is shown in Figure 3. An equilibrium loss rate of 7000 gpm was calculated. The water table elevation and rise at key facilities in the northern portion of the Hanford groundwater system are contained in Table 025.1c-3. The only rise of significance is beneath the 100-N Crib showed a rise of 15 feet. However, the predicted water table elevation at this location is not much greater than that which was observed when the B and K reactors were in operation.

There was no appreciable water table rise south of Gable Mountain; therefore, the effect on the 200 Separations Areas, the Wye and 300 North Burial Grounds, and the 300 Area facilities is negligible. This agrees with historical observations where recharge from cooling basin leaks and cribs in the 100 Areas has had little effect on water table changes south of Gable Mountain.

4. Hydrologic Evaluation of the Discharge of Cooling Tower Blowdown at the Sand Dunes Site

In an attempt to locate a pond site that would be acceptable for disposal of cooling tower blowdown, a site located in the sand dunes area northeast of Site C was selected (Figure 025-10). The selection was based upon an examination of the transmissivity distribution shown in Figure 025-9. A pond in this area does not block the major channels of flow from 200 East Area to the river. The pond was assumed to have a held potential of 440 feet and covered approximately 2.4 x 10^7 feet^2. The pond shape and location are shown in Figure 3. The case study showed that 5400 gpm could be disposed to the pond. The water table elevation and rise at key facilities are contained in Table 025.1c-3. A groundwater rise of 9 feet would ultimately occur beneath 200 East Area. The rise beneath 200 West Area would be negligible.

5. Seepage Loss Rates as a Function of Time

The initial loss rates from the unlined ponds could be considerable. If supplied, the loss rate could initially approach 400,000 gpm/square mile. A substantial reduction in the initial loss rates should occur rather rapidly but equilibrium conditions would not be reached for a period of years. The equilibrium steady loss rates for the three unlined cooling ponds were computed to be approximately 10,000 gpm.

TABLE 025.1c-3

Site	Facility	Wye Burial Ground	300-N Burial Ground	321 Crib	FFTF Facility	HTSF Facility	LMFBR Facility	200-E Area	200-W Area	100 B-C Burial Site	100-K Burial Site	100-D Burial Site	100-H Burial Site	100-F Burial Site	P-11 Facility	100-N Disposal Crib
	Structure Base Elevation	416	416	421	468					460	460	440	400	380	390	440
	Present Groundwater	392	372	370	395	341	341			393	383	383	375	365	357	397
Site C	1.7×10^6 ft^2 Pond Size 2700 gpm unlined	406	380	377	405	342	343	+8	N							
Site C	3.1×10^6 ft^2 Pond Size 3400 gpm unlined	409	381	379	408	342	343	+9	N							
Site C	1.5 sq mile Pond Size 6800 gpm/sq mile unlined	434	398	395	430	342	343	+25	+1 to 9							
Site C	1.5 sq mile Pond Size 1000 gpm/sq mile lined	396	374	372	397	342	342	N	N							
Site C	2.5 sq mile Pond Size 4000 gpm/sq mile unlined	434	404	401	432	342	343	+25	+1 to 9							
Site C	2.5 sq mile Pond Size 1000 gpm/sq mile lined	399	380	378	401	342	342	N	N							
Site C	3.5 sq mile Pond Size 2900 gpm/sq mile unlined	435	407	404	434	342	343	+25 to 30	+1 to 9							
Site C	3.5 sq mile Pond Size unlined + Ben Franklin Dam	435	412	410	434	346	347	+25 to 30	+1 to 9							
Site C	3.5 sq mile Pond Size 1000 gpm/sq mile lined	400	382	379	402	342	342	N	N							
Sand Dunes Site	Unlined Pond, 5400 gpm	406	380	377	405	342	343	+9	N							
Site C	3.0 sq mile Pond Size 16,800 gpm, 400 el., unlined	411	394	394	412	342	343	+13	N							
Site C	3.0 sq mile Pond Size 17,500 gpm, 410 el., unlined	413	398	399	413	342	343	+13	N							
Site C	1.5 sq mile Pond Size 4100 gpm, 410 el., unlined	400	392	393	403	342	343	+6	N							
Site B	1.4×10^6 ft^2 Pond Size 7000 gpm, unlined							N	N	393	387	389	377	366	358	412

\+ Valves Represent Groundwater increases. All others in feet above MSL

N Means Negligible

TABLE 025.1c-4

TIME FACTORS FOR VARIOUS LOSS RATES TO CAUSE THE WATER TABLE RISE PREDICTED FOR THE UNLINED, 3-1/2 SQ. MILE POND

Loss Rate (gpm)	Time Factor (yrs.)
5,000	118
10,000	59
15,000	39

Adequate Water Flow

After the addition of new reservoir projects to be added upstream from Hanford No. 2, there will be almost 35 million acre/feet of active storage by 1973; this is equivalent to a continuous flow of 115,000 cfs for 150 days. Because of regulation, it is anticipated that the minimum and maximum monthly mean flow rates will be 60,000 and 260,000 cfs in the vicinity of Hanford No. 2. Flows as low as 36,000 cfs (minimum licensed release for Priest Rapids Dam, River Mile 397) may be experienced for short periods of time (24-48 hours). 1/

Hanford No. 2 is close to the southern edge of the upper Columbia sub-region of the Columbia-North Pacific region as defined by the Pacific Northwest River Basins Commission. 1/ The upper Columbia sub-region lies totally within the State of Washington and includes most of the northeastern portion of the state.

As of 1967, active water rights in the upper Columbia sub-region allow consumptive or partially consumptive diversions of 6,343 cfs of surface water and 1,870 cfs of ground water.

The flow characteristics of the Columbia River is discussed in detail in pages 1 through 4 of this section.

Total Known and Future Requirements of Hanford No. 2

The amount of water required for construction and operation of Hanford No. 2 is discussed in Section 010(2). The amount of water for cooling tower losses (evaporation) and for discharge to the river (blowdown) will vary during different seasons of the year.

During the winter the low ambient temperature and consequent (sensible heat) loss will reduce the amount of evaporation (lantent) required to maintain condenser cooling water temperatures. Thus the variations in the evaporative loss and the resulting variations in the blowdown requirements will require that the plant requirements be discussed in terms of maximum requirement. With cooling tower evaporative losses of 13,500 gpm (33.5 cfs) a blowdown rate of up to 6,500 gpm may be required to control circulating water densities within acceptable levels. The blowdown quantity will be a non-consumptive use of the Columbia River water.

The makeup from the Columbia River will be withdrawn at a normal maximum rate of 25,000 gpm (55.8 cfs) which is less than 0.05% of the average annual flow of 115,000 cfs. Table 025.1c-5 lists makeup (river withdrawal), evaporation, and blowdown (return to river) rates for variable conditions as discussed in various parts of this application.

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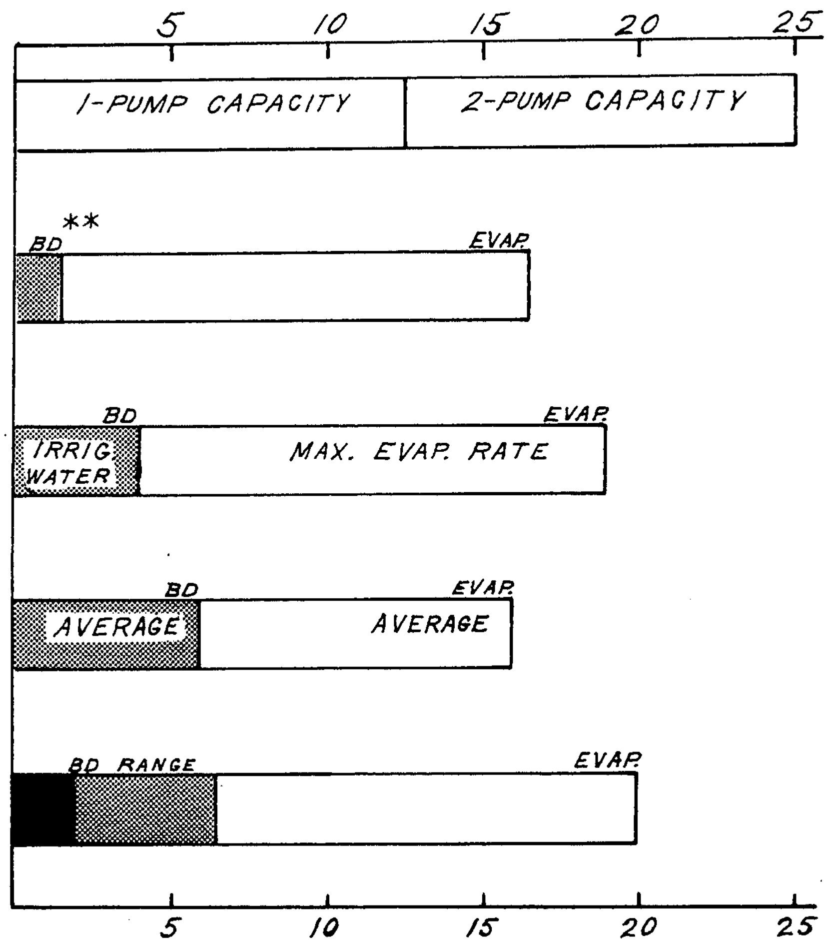
Cooling tower evaporative losses of 13,500 gpm (33.5 cfs) will require up to 6,000 - 6,500 gpm. This blowdown quantity will be a non-consumptive use of Columbia River water.

Table 025.1c-5

MAKEUP, BLOWDOWN AND EVAPORATION*RATES

* Evaporation including drift



** BD = BLOWDOWN

G.P.M. - Thousands

025(2b)-Pg 2	Discussion of pump and intake filter design sizing and maximum normal rate of river withdrawal for circulating water system filling
010(2)-Pg 2 025(2e)-Pg 3	Comparison of concentrated salts required that conservative numbers be used to show highest concentrations-1500 gpm blowdown vs. 15,000 gpm evap.
025(1b)-Pg 2	Estimates provided for discussion of multipurpose use of blowdown and waste heat dissipation
025(1c)-Pg 9 025(2b)-Pg 2 025(2e)-Pg 5	Discussions of river withdrawal rates and dissolved solids return to river
025(1c)-Pg 15 025(2a)-Pg 5 025(2c)-Pg 2&3	Evaporation (13,500 gpm) for discussion of humidity downwind from cooling towers. Blowdown (6,500 gpm) for conservative discussion of jet discharge rate dispersion characteristics.

<u>WAC 463-12-025</u> - QUALITY OF THE ENVIRONMENT - WATER

(2) Quality.

(a) Provide plans for the compliance with regulations relating to water quality standards for waters of the State of Washington.

Project administration programs will be managed so as to minimize all avoidable release of undesirable discharges of chemicals and other noxious wastes during construction, testing and operation of the Project.

The Project will be designed to use a cooling pond which will comply with State regulations relating to water quality. The only area of concern with regard to water quality in this type of cooling facility is the disposition of any blowdown water and possible seepage from the cooling pond. The standards of Chapter 372.12 of the Washington Administrative Code will be met by cooling facility designs related to the disposal of blowdown water and seepage from the cooling pond.

Environmental Effects of Hanford No. 2 Discharges

The quality of water in the Columbia River opposite Hanford No. 2 is characterized by the State of Washington as Class A Excellent and water quality standards have been specified for this class[2]. The temperature standard is quoted in Section 025(2)(e). The remaining standards are as follows:

> Total Coliform Organisms shall not exceed median values of 240 (FRESH WATER) with less than 20% of samples exceeding 1,000 when associated with any fecal source or 70 (MARINE WATER) with less than 10% of samples exceeding 230 when associated with any fecal source.
>
> Dissolved Oxygen shall exceed 8.0 mg/l (FRESH WATER) or 6.0 mg/l (MARINE WATER).
>
> pH shall be within the range of 6.5 to 8.5 (FRESH WATER) or 7.8 to 8.5 (MARINE WATER) with an induced variation of less than 0.25 units.
>
> Turbidity shall not exceed 5 JTU over natural conditions.
>
> Toxic, Radioactive or Deleterious Material Concentrations below those of public health significance, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect any water use.
>
> Aesthetic Values shall not be impaired by the presence of materials of their effects, excluding those of natural origin, which offend the senses of sight, smell, touch or taste.

Hanford No. 2 will introduce no coliform organisms into the Columbia River (refer Section 025(2)(g)).

Water leaving the cooling tower system for Hanford No. 2 will be saturated with air. As long as the water temperature is 77°F or less the oxygen content of the blowdown water will be at least 8.0 mg/l. At the maximum expected blowdown water temperature of about 90°F the oxygen content would be 7.3 mg/l.

Since the oxygen content of the Columbia River ranges from 9.5 to 14.0 mg/l, even the warmest blowdown water will comply with State quality standards for oxygen if mixed with a comparable quantity of river water.

Blowdown water from Hanford No. 2 will have a pH between seven and eight, which is within the permissible range for Class A water.

For a given dispersion of solid material into fine particles, the Jackson Turbidity Unit is a measure of the amount of suspended material in water. The turbidity of the Columbia River is normally less than one Jackson Turbidity Unit. The turbidity of the blowdown water due to airborne particles should be less than 100 Jackson Turbidity Units under the most severe dust conditions. If a maximum of 5,500 gpm of blowdown with a maximum of 100 Jackson Turbidity Units is mixed with a minimum of 36,000 cfs of river water containing negligible turbidity, the turbidity of the river would be increased by about 0.03 Jackson Turbidity Units, which is well within the State water quality standards.

The salts which are returned to the river consist primarily of salts originally present in the river. The increase in concentration of dissolved solids in the river will be too small to be measured since there will be dilution of at least a factor of 3,000. The fine particles of sand suspended in the blowdown during dust storms are inert particles of silica with no biological significance. The chlorine content of the blowdown will be negligible.

No material will be introduced to the Columbia River which will impair aesthetic values.

Calculations have been made of the effluent mixing zone including the longitudinal and lateral distances for dilution to the 1/2°F isotherm. Figure 025-11 is a graphic display of the river isotherms and dilution downstream of the outfall. The 1/2° criteria has been adopted by the Department of Ecology as the limit of "measurable" temperature.

The present prohibition against unlined ponding in the Hanford No. 2 area precludes the use of a settling basin to minimize blowdown turbidity during periods of severe dust conditions.

The turbidity of the blowdown water under the most severe dust conditions and the resulting effect upon the river water quality is discussed on page 3 of this section. Percolating cooling tower blowdown to the groundwater table is unacceptable to the AEC. The discharge will be designed to provide complete mixing in a minimum time.

The mechanical draft cooling tower system for Hanford No. 2 will require four banks of cooling towers each having approximately 12 cells. The total heat rejection will be 7.88×10^9 BTU per hour and an air flow rate of approximately 1.54×10^6 CFM per cell.

The precise dimensions of the towers and the final design will depend upon the particular manufacturer selected to supply the equipment. The general appearance of the tower is shown by the artist's rendition in Section 040 and the tentative plan view of a possible tower layout is shown by Figure 010-10.

In summer most of the heat removed by the cooling tower from the water is used to evaporate about two percent of the total condenser flow of 525,000 - 550,000 gpm, and somewhat more than 13,000 gpm will evaporate. In the winter, more heat is used to warm the air and less to evaporate water, so the evaporation rate is only about half as great as for summer conditions. During winter conditions, air flow will be reduced by shutting down segments of the cooling tower array.

Evaporation from irrigated lands in the Yakima River Valley is about two million gpm in the summertime. The additional evaporation of 13,500 gpm from Hanford No. 2 will cause only a slight increase in the humidity downwind from the plant.

(2) Quality.

(b) Provide plans for waste heat dissipation at all proposed sites including plans for off-stream cooling facilities for power sites located adjacent to fresh water bodies and estuarine locations.

The preliminary project plans for cooling facilities, including the cooling pond, will be submitted at the time such plans are completed by the Architect-Engineer (not later than July 1, 1971).

Cooling Water Intake Structures

The major concern and interest for fish protection facilities at Hanford are focused on the Pacific salmon and the steelhead trout, because of their dominant importance in the commercial and sport fishery. The makeup water pumphouse for Hanford No. 2 is designed in a manner which will essentially eliminate adverse effects on these and other fish.

It is presently planned that the pumphouse will contain three pumps, each of which will have a capacity of 12,500 gpm against an 80-foot head. Only two of these pumps are to be operated at any one time, with the third pump being a spare pump. Hence, maximum planned makeup from the river will be 25,000 gpm. Average makeup during the year will be about 16,000 gpm.

The intake for the makeup water supply to the cooling pond will be of the infiltration type wherein the water enters the pumping system through a filter bed in the bottom of the Columbia River. The average velocity of water entering the filter bed will not exceed 0.02 feet per second.

Details of the proposed filter intake and the proposed pump structure are shown on Figures 025-6 and 025-7. The principal elements are as follows:

(1) A filter bed along the shore, underlain by perforated collecting pipes.

(2) Non-perforated standard pipes extending from the filter bed area approximately 400 feet to a pump structure

located at the high water bank of the river, well inland from the normal river bank.

(3) Pump structure which will contain only the pumps, associated electrical equipment and surge protection devices for the makeup water pipeline. There will be no water screens, since all debris and fish will have been prevented from entering the system at the river filter bed.

(4) A backflush system to clear the intake system if it should become clogged.

Optimization studies presently underway may result in changes to the details described herein, particularly with respect to the filter bed design. A river bottom filter will also be evaluated. The filter bed concept will be retained, however, and any changes will not influence the environmental features of the plant.

The filter bed as presently proposed will extend along less than 1/2 mile of shoreline. A possible alternative in the river bottom would cover a maximum of about one acre.

With reference to the proposed design, Dr. Ernest O. Salo, Consulting Biologist, states:

> "The concept is an excellent one from an environmental point of view. With velocities of less than 0.02 feet per second, it is expected that no problem will exist with either impingement or attraction of fishes to the system.
>
> "The system will not occupy an area large enough to have influence upon the spawning areas and its location is versatile enough to avoid any dense concentration of spawners. The spawning chinook in the Hanford area have shown a consistent pattern in selection of spawning sites, i.e., they utilize the same areas year after year; thus, their areas of spawning can be avoided.

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> "The current patterns over the filter system will not be attractive to spawners as the current pattern is essentially one of downwelling while spawners seek out areas of upwelling."

Larval forms of salmonids and other important fish species will be restricted from the cooling water by the intake infiltration. The larval forms of some course fish plankton may be small enough to penetrate the filters. The numbers that will be destroyed will be extremely small compared to the total contained in the river.

Mechanical Draft Cooling Tower System Description

Condenser cooling water for Hanford No. 2 will be provided by a closed cycle system utilizing conventional mechanical (induced) draft cooling towers. Four (4) sets of towers, each set with 11 or 12 cells, will be provided. The system will be designed to cool 525,000 to 550,000 gpm of condenser cooling water rejecting approximately 7.7 x 10^9 Btu/hr to the atmosphere. The towers will be arranged on the site as shown on Figure 010-11 Overall Site Plan.

Cooling water required for indirect condensing of the turbine exhaust steam will be supplied to the condenser (tube side) by circulating water pumps to be located adjacent to the cooling towers. These pumps will take suction from the tower basins and will be designed with sufficient head to pump through the condenser back to the cooling tower distribution system where ultimate heat rejection takes place.

The cooling towers will have an approximate height of 60 ft. to the top of the fan stacks. Each cell will be provided with a 200 hp, 28 ft. diameter fan used to induce the draft required to operate the cell. The exit (discharge) velocity from the cell will be approximately 33 fps.

A mechanical draft tower system utilizes evaporative cooling in which cooling is achieved principally by bringing cold air and hot water into contact. Hot water, introduced into the tower system via the distribution piping, flows by gravity through fill material where it comes in contact with air and is thereby cooled.

The cooled water is collected in basins at the base of the tower. Air is introduced into the tower through louvered side panels and flows upward through the tower fill material and is discharged to the atmosphere after passing through drift eliminators and finally through the fan stack which houses the air moving equipment.

During the cooling process a small percentage of the total flow being cooled is lost due to evaporation and drift. Additional water is lost from the system through system blowdown which is required to maintain the concentrations of solids in the closed cycle at required limits. A makeup system consisting of 3-50% capacity pumps located in a pumphouse structure on the Columbia River will provide the necessary makeup to keep the system in equilibrium.

In the design of the cooling tower system described above, system features related to environmental matters such as those listed below are considered and reported separately.

1. Blowdown requirements including outfall structures
2. Makeup requirements
3. Meteorological effects
4. Hydrological effects
5. Chemical and Thermal effects on natural bodies of water

Since cooling ponds and direct cooling have been eliminated from consideration, a cooling tower system is the remaining alternative choice available for the transferrence of large quantities of heat away from Hanford No. 2 without heating nearby water supplies. The water cooling tower is an interim heat sink, transporting all its heat directly to the atmosphere. The function of a cooling tower is to cool the incoming water to the power plant. The air is heated and humidifed as it flows counter to the water. The water circulating to the tower from the condenser is cooled by both evaporative and sensible heat exchange.

A multiple cell mechanical draft cooling tower installation is an extremely reliable system for rejecting waste condenser heat. In optimizing the turbine, condenser, and cooling tower designs, the engineer must consider the variations in heat load and coincidental weather conditions; the performance variables that occur within the condenser and the cooling towers; and the changes in efficiency of the steam turbine as these various loads occur at different back pressures.

The turbine and condenser designs are matched to the extent that optimum plant performance occurs at a particular condenser pressure. The condenser pressure is a function of the temperature of the cooling water returning from the tower, therefore the tower should be capable of providing the water within a specified temperature range.

The consequences of shutting down a cooling tower cell for maintenance would have a minimal impact on the power plant. If such a shutdown occurred during severe summer weather conditions, slightly warmer water would be returned to the condenser from the cooling tower. This would result in an increase in condenser back pressure and a consequent decrease in turbine-generator output. This would ultimately result in an increase in fuel cost per unit of generated power, however there would be no safety implications whatsoever.

The cooling towers will be designed to provide suitable cooling water with a 28.7°F range during 70°F wet bulb conditions. This is the highest wet bulb temperature ever recorded in the Hanford area, hence the cooling tower system will provide adequate cooling during the most severe summer wet bulb conditions recorded.

Analyses of alternate methods of waste heat dissipation for the proposed Washington Public Power Supply System's Hanford Number Two Nuclear Power Plant have embraced consideration of direct discharge to the Columbia River, off-stream cooling by ponding near the site, and evaporative type cooling towers. Because of concern over the effect of heated discharges on aquatic life in the Columbia River, direct river cooling was considered unacceptable. Ponding, although a preferred choice from an operating standpoint, was eliminated as an alternative when hydrologic studies showed that seepage would raise the underlying water table to the extent of causing potentially adverse effects on the Atomic Energy Commission's Wye Burial Ground used for disposal of radioactive solid wastes. Therefore, attention was directed to the remaining alternative of evaporative type cooling towers.

The evaporative cooling towers are intimately coupled to the plant heat cycle such that sizing is very importantly related to the generating plant operating characteristics. Removal of heat in a cooling tower is a combination of sensible heat transfer and evaporation between the warm water droplets falling through the tower fill material and the main body of air which is drawn from the atmosphere through the fill material. For a cooling tower to operate, air flow must be created in the tower. In the natural draft hyperbolic tower, air flow is established by the natural draft principle; e.g., the temperature difference between the atmospheric air and exhaust air from the cooling tower inside the hyperbolic shell create a density difference which induces air flow through the system. In the mechanical draft tower, large electric motor driven fans are used to induce air flow such that operational stability problems associated with the natural draft system are overcome.

A hyperbolic natural draft tower appeared initially to be an effective method of handling the cooling task and offered some advantages with regard to environmental considerations because of the great height of the hyperbolic shell. However, attempts to interest vendors in supplying such a tower with a performance warranty under the climatic conditions at the proposed site were not fruitful. Consequently, the mechanical draft systems were examined in more detail in terms of environmental consequences and were found to have little impact on the surrounding area, at the same time providing improved operational reliability over the natural draft system.

(2) Quality.

(c) Submit completed studies prior to site certification to identify the outfall configuration and locations, heated effluent distribution characteristics and extent of the dilution zone.

As described in Section 025(2a), the only area of involvement of the proposed cooling system with State water quality standards will be the loss of cooling pond water. Outfall design configuration and other supporting analyses will be furnished by July 1, 1971.

The blowdown from the cooling towers will be discharged into the Columbia River at an expected rate varying between 6500 gpm (14.5 cfs) and 2000 gpm (4.5 cfs) with concentrations of river salts at 3 and 10 timesbackground respectively.

The discharge will be effected by means of an 18" pipe from the cooling towers buried in a common trench with the makeup water piping and returned to the river south of the makeup water pumphouse, after crossing over the infiltration piping. It will project 50 ft. riverward from the low water line and be directed slightly downstream with an open end discharge which has a slight vertical vector to allow burial in the river bed to prevent scour. Fish spawning areas will be avoided through consultation between the Supply System consultants and the appropriate agencies represented on the Council.

Design Alternatives

The decision in favor of the above described discharge was arrived at after consideration of a number of alternatives.

It is technically feasible and considerably more economical to divert the blowdown discharge to a depression near the cooling towers. Such a depression is available close to and easterly from the tower location. However, due to potential long-range effects on the groundwater profile which could in turn, affect the present subsurface radiological balance within the Hanford reservation, this means of blowdown disposal was discarded.

Other sites closer to the river were considered and discarded for the same reason in spite of the reduction in potential effect on groundwater. The major concern was the lack of specific and finite knowledge of the amount and location of radioactive wastes in the affected areas.

Consideration was also given to a diffuser type of discharge wherein the system would be similar to the one chosen except that the end section would be replaced with a capped pipe and perforated wall along 15 feet of its outboard terminus. The difference between the jet and diffuser types of discharge are relatively minor, the most significant being the manner and effectiveness in which the mixing action between the discharge and river water is accomplished. The jet discharge provides mixing at the boundary of the discharge stream and forces the discharged materials farther into midstream where it is readily mixed with the river water.

Dispersion Characteristics

The jet discharge will be at a rate of 6,500 gpm (14.5 cfs) and an exit velocity of approximately 7 fps. The introduction of this volume of water into the Columbia River which has a minimum controlled flow of 36,000 cfs is insignificant. The jet effect of the discharger will permit complete mixing in minimum time.

Dilution Characteristics

The concentration of salts at even ten times the background quantities is not considered to pose a significant problem for aquatic life since there would be almost immediate dilution of the salts by the river water. Similarly, the discharge of 14.5 cfs of water elevated to a temperature of 90°F would have an insignificant thermal effect in this portion of the river.

Possible Paths of Reconcentration of Waste Discharge

Reconcentration of waste discharges is not considered feasible due to the extreme dilution which will occur.

Section 025(2)(a) including the supplemental filing August 27, 1971 contains further discussion of the dispersion, dilution of the plant blowdown and compliance with State of Washington water quality standards.

(2) Quality.

(d) Provide an engineering report, plan and specifications which will reflect all known, available and reasonable methods of treatment of waste discharges, including, but not limited to, biocides, blowdown water, plant floor drains, sanitary sewage, and other waste discharges from the facility to state waters.

Plant wastes will include radioactive wastes which will be processed in a radioactive waste facility and disposed of in compliance with AEC regulations. The type and nature of such wastes will depend on the nuclear steam supply system selected and cannot be defined at this time.

Non-radioactive wastes will be limited at the Hanford site. It is anticipated that concentrations of biocides and salts in blowdown from the cooling pond will be minimal.

Facilities will be provided for treatment of sanitary sewage.

An engineering report on the Project's waste disposal system will be prepared after the nuclear steam supply system has been selected and will be submitted to the Council not later than September, 1971.

An engineering report included in this section, and prepared by R. W. Beck and Associates, reflects all known, available and reasonable methods of treatment of waste discharges, including biocides, blowdown water, plant floor drains, sanitary sewage and other waste discharges.

An evaporative mechanical draft cooling tower system will be provided for Hanford No. 2 to dissipate the waste heat to the atmosphere and avoid thermal impact on the Columbia River. The cooling tower system described in Section 025 (2)(b) was selected instead of a cooling pond to comply with AEC requirements that the Supply System installation not perturb the water table.

A description of the chemical treatment methods and chemical discharges from Hanford No. 2 is contained in Section 025 (2)(e).

The Hanford No. 2 radiological treatment systems are described in Section 030 (3) (Contaminant Emission Control Facilities - Air with Figure 030-8) as well as Section 025 (2)(g) Liquid Waste Treatment - Water with Figure 025-5).

The use of chemicals, chemical treatment and chemical discharges is contained in Section 025 (2)(b).

Mechanical draft towers are sized with respect to wet bulb temperature while relative humidity has little effect on performance. A natural draft tower is influenced by both relative humidity and wet bulb temperature. For air movement, a natural draft tower depends on draft created by the difference in density of the entering and leaving air. This potential driving force is the difference in weights of two columns of air of equal height and cross sectional area, one inside the tower and the other outside.

Favorable natural draft occurs when the wet bulb temperature is low and the relative humidity high. These foregoing conditions do not prevail in the Hanford region during several months of the year.

Consequently a natural draft installation designed for suitable performance during the winter months would yield inadequate performance during the summer. It could not provide cooling water at an adequate temperature for acceptable condenser performance.

In addition, an economic analysis evaluating the capital costs, auxiliary power requirements, pumping costs, and maintenance costs has shown clear advantages for the mechanical draft system over a natural draft tower.

The applicant asserts that the information prepared and filed with the Council is evidence that the Supply System will "make use of the best known, available, and reasonable methods for the treatment of waste discharge" including "treatment facilities for chemical discharges, blowdown water, plant floor drains, sanitary sewage and other waste discharged from the facility".

In addition to the detailed descriptions contained in various sections of the application, the Supply System has filed with the Council, in Section 050 (1)(d), a statement of construction costs and annual costs attributable to equipment, monitoring, recycle systems and aesthetics to insure that the quality of the environment is maintained. Table 050.1-1 contains a listing of the capital cost estimate of the environmental features totaling $39,336,000. The Supply System has furnished the Council with information on the alternative waste heat handling methods, alternative methods of handling blowdown discharge and the reason for selecting the Columbia River as the receptor, the description of the environment and the selection of the environmental, radiation monitoring system. The Supply System has also supplied plans for the architectural and landscaping treatment of the site.

If the Council desires, the Supply System will file a discussion of other alternatives such as power purchase alternatives outside of the region, alternative generating resources in the region, alternative sites away from the Hanford Reservation and alternative sites within the Hanford Reservation.

R. W. BECK AND ASSOCIATES

ANALYTICAL AND CONSULTING ENGINEERS

PLANNING
DESIGN
RATES
ANALYSES
EVALUATIONS
MANAGEMENT

200 TOWER BUILDING
SEATTLE, WASHINGTON 98101
TELEPHONE 206-622-5000

SEATTLE, WASHINGTON
DENVER, COLORADO
PHOENIX, ARIZONA
ORLANDO, FLORIDA
COLUMBUS, NEBRASKA
BOSTON, MASSACHUSETTS

FILE NO. SS-1119-NP-ACS

December 8, 1970

LIQUID WASTE TREATMENT METHODS

This is a summary report of available methods for treating liquid wastes of the type that will be produced by the Hanford No. 2 nuclear power plant.

The report has been prepared pursuant to Section 463-12-025, Water, (2) Quality, (d) of the Washington Administrative Code, Guidelines for Thermal Power Plant Site Certification which requires that an applicant:

> "Provide an engineering report, plan and specifications which will reflect all known, available and reasonable methods of treatment of waste discharges, including, but not limited to, biocides, blow-down water, plant floor drains, sanitary sewage, and other waste discharges from the facility to state waters."

Three types of waste liquids will be produced by the Project: (a) ordinary sanitary sewage, (b) process liquid waste and (c) "blowdown" flow from the offstream condenser cooling system.

The blowdown flow stream (c) will originate from the Project cooling pond, cooling canal, or cooling tower flow circuit depending upon which of these systems is selected for condenser cooling. This stream will consist of condenser cooling water that is concentrated with respect to impurities as a result of evaporation that takes place in the cooling system. The stream may also contain chemical additives for controlling corrosion and slime formation in the system.

Process liquid waste (b) will consist of effluent from the reactor cooling system, from plant auxiliary systems, from equipment decontamination, from the process coolant purification system and from other sources that are processed through the plant liquid waste system. This is the only one of the three Project liquid waste categories that may contain radioactive waste material created by the Project.

A description of "state-of-the-art" waste treatment methods applicable to the Project follows.

SANITARY LIQUID WASTE

The average contributory population to Project sanitary wastes is estimated to be 30 to 40 people per day with a peak of 200 people per day. The waste flow, consisting of domestic sewage and kitchen waste, is estimated at 50 to 75 gallons per capita per day. Soil at the site is sandy till having good drainage characteristics. The site is remote and access is restricted. The nearest municipal sewage system is that of the City of Richland, Washington approximately 12 miles south of the Project. Considering the aforementioned waste and site characteristics, the following potential treatment schemes appear germaine:

1. Septic Tank(s) Followed by a Drainage Field

   The primary function of a septic tank is to condition sewage so that it will minimize clogging of the drainage field to which clarified liquids flow. This conditioning is accomplished by providing holdup to permit partial settling-out of the sewage solids (sludge). The sludge undergoes anaerobic decomposition, and grease/scum float to the surface of the tank. Clarified liquid from the zone between the sludge and scum flows to a drainage field and percolates into the ground. A low degree of bacterial removal is accomplished.

2. Aerobic Lagoon

   The aerobic lagoon is essentially a shallow body of water into which untreated sewage is introduced and detained for a period of time sufficient to permit stabilization of the sewage solids by a fairly complex natural process. During the detention period, organic materials in the sewage are stabilized by aerobic bacteria and algae, assisted by wave action and sunlight.

   Waste stabilization ponds have been designed so that no effluent is discharged from the pond - the sewage inflow is balanced by evaporation from the surface of the pond coupled with percolation into the soil. Where ponds are designed to overflow, the effluent may be discharged to a drainage field or to suitable receiving waters after chlorination.

3. Aerated Lagoon

The aerated lagoon accomplishes stabilization of organic materials contained in the waste by diffusing oxygen through the sewage liquor so that aerobic bacteria and other organisms can oxidize and stabilize the organic content. Aerated lagoons are generally 8 to 15 feet in depth and utilize mechanical aerators (low-head propeller pumps) or compressed air for mixing and diffusion of air.

By providing a quiescent zone at the end of the final aeration cell, the turbid mixed-liquor contents can be clarified and then discharged to a drainage field or to suitable receiving waters after chlorination.

4. Activated Sludge (Extended Aeration Modification)

In this system the raw sewage is introduced into an aerated basin and kept under aeration for a period of approximately 24 hours. The activated sludge biological solids which form under this aeration are settled out in a final settling basin and the treated effluent can then be discharged to a drainage field or to suitable receiving waters after chlorination.

This type of treatment can be accomplished in earth or concrete-lined aeration basins of various shapes or in steel fabricated units.

PROCESS LIQUID WASTE

This part of the report describes treatment methods for process liquid wastes from nuclear power plants. A section describing the sources of radioactive material in process liquid waste streams has been included as an aid to understanding the treatment methods.

1. Sources of Radioactive Material

An authoritative review of sources of radioactive material in nuclear power plants was made by Dr. Theos J. Thompson, Commissioner, U. S. Atomic Energy Commission, before the Joint Committee on Atomic Energy in 1969 as follows*:

* - Environmental Effects of Producing Electric Power, Hearings before the Joint Committee on Atomic Energy, Congress of the United States, Oct. - Nov., 1969, U. S. Government Printing Office, pp. 176, 177.

"Essentially all radioactive material produced and present in the primary coolant system of PWR's and BWR's is contained in the primary coolant system. Very small amounts of this radioactivity, however, may occasionally escape from the primary coolant system through leaks such as steam generator leaks. Some is released or removed from the primary system and processed as radioactive waste; most of this material, after processing to separate it from the water, is packaged in sealed, shielded containers and shipped from the reactor site to a location where it can be permanently stored safely. Only a very small amount of the radioactive material produced is permitted to be released to the environment; the radioactivity released usually arises from the diluted materials left in the water after most of the radioactivity is removed.

"There are several types of radioactive materials created during reactor operation. The most important of these are the radioactive fission products, the nuclear fragments of the fission process, which are formed in the fuel. The most common fuel element designs used in water-cooled power reactors today consist of small right cylindrical fuel pellets of uranium oxide which are stacked end to end within metal tubes. These tubes (the fuel cladding) are usually made of an alloy of zirconium or stainless steel. There are from 20,000 to 30,000 of these tubes about one-half inch in diameter and about 12 feet long in our present-day power reactors.

"Most of the fission products are retained within the fuel material. Further retention is provided by the fuel cladding. Because of retention in the fuel and the high level of integrity of the fuel cladding, experience has shown that only a very small percentage of these fission products are released into the reactor coolant. Those which do reach the reactor coolant are primarily the gaseous or more easily vaporized constituents of the fission product mixture, which may escape through small cladding defects. Cladding failures that have occurred have normally been of the "pin hole" type; that is, a small hole develops from such things as localized corrosion, weld defects, etc.

"The AEC requires that reactor fuel be designed to very high standards of integrity. Throughout the history of the nuclear industry, there have been extensive programs of research to develop improved fuel composition and improved fuel cladding and to increase our understanding of the performance of fuel under reactor conditions. These programs, which have been carried out both by the AEC and by the nuclear industry, have led to substantial improvements in fuel element performance through the years. These steps toward assuring containment of fission products within the fuel elements have provided an important method by which radioactivity releases to the environment are being kept very low.

"Individual fuel elements are manufactured in large numbers. In spite of extensive quality assurance programs and other measures, some mechanical defects in fuel elements occasionally occur. Corrosion of the cladding at localized spots also has occurred: thus, there have been some fuel failures in operating reactors, but the number of such failures generally has been well below the value of 1% defective fuel conservatively assumed as the basis for the design of waste treatment systems.

"Radioactive isotopes of the noble gases xenon and krypton, which are produced as fission products, are of special interest. These gases escape from fuel elements which have cladding defects and, because they are essentially inert chemically, they remain in a free form in the reactor coolant. The isotopes of xenon and krypton which do escape, with the exception of krypton 85 (which I will discuss later), have short half-lives and decay rapidly; and thus can be controlled by holdup to permit decay.

"Another source of radioactive material in nuclear power plant effluents is radioactive corrosion products present in the primary coolant system. Radioactivity is induced in the materials in the reactor core by nuclear reactions. Although the quantity of radioactive material produced in this manner is small compared to the radioactivity of the fission products, it nevertheless accounts for much of the radioactivity in the primary coolant because it is formed in the water outside of the cladding of the fuel elements. While these corrosion products are an important consideration for plant maintenance, they are in the form of solids or dissolved salts which are readily removed from the water by conventional purification techniques.

"Tritium is produced, in relatively small amounts, as a fission product; most of this is retained within the fuel. Additional tritium comes from chemicals which may be added to reactor coolant systems to provide an additional means of reactor control or to provide specialized coolant chemistry conditions. Tritium is produced by interaction of neutrons with these chemicals, or with the small amount of heavy hydrogen (deuterium) in the water itself.

"Additional radioactive materials result from the neutron irradiation of the impurities and the chemical additives present in the reactor coolant water. While this water is purified by demineralization before use in the reactor (to purity higher than that of the water we drink), some small quantities of impurities are present. Another source of radioactivity may arise from trace amounts of uranium contaminating the exterior surfaces of the fuel cladding in the core. Still another source of radioactive material results from the neutron interactions with the coolant water itself, producing short-lived isotopes of nitrogen and oxygen. The most abundant of these is nitrogen 16, which decays with a seven-second half-life. This half-life is so short that this isotope is not an important consideration as regards discharges from the nuclear plant."

The above discussion by Dr. Thompson concentrated on boiling water reactors (BWR's) and pressurized water reactors (PWR's) which are the most common types of power reactors in use in the United States today. The sources of radioactive material in gas-cooled reactors are to some extent different than those of water-cooled reactors. Use of gas as the reactor core cooling medium, for example, eliminates radioactive material created from cooling water additives or impurities found in water-cooled reactors. In addition, corrosion is expected to be negligible in the case of the gas-cooled reactors and only small quantities of activated corrosion products are anticipated.

Although most radioactive material remains in primary systems, some is deliberately removed and some escapes to be subsequently treated in waste cleanup systems. Filtration and demineralization beds remove suspended and dissolved solids in the primary coolant - on a continuous basis. Periodic samples of primary coolant and cover gas are removed for laboratory analysis and released to drains and vents. Steam ejectors and seals are a source of additional leakage during reactor operation. During refueling outages, the primary system is opened and additional radioactive material leaves the primary system with miscellaneous leakages when core equipment and instrumentation is removed for replacement or repair and when spent fuel is replaced. Radioactive material leaving the primary system is conducted to the liquid waste cleanup system by means of various building drains.

2. <u>Liquid Waste Treatment</u>

Process liquid waste systems are designed to:

a. collect all liquid wastes from in-plant sources;

b. utilize a combination of filters, evaporators, demineralizers and centrifuges to separate "clean" liquids for re-use;

c. collect concentrated wastes for solidification and shipment to approved storage depots;

d. collect the remaining liquids, test to assure that radioactivity levels are low enough to permit safe discharge to the environment, dilute it, and release it at a controlled rate by mixing with condenser coolant discharge;

d'. alternatively, process liquid waste as in step d may be more completely purified and a greater percentage of the total returned to the process for re-use. Provision can then be made to solidify slurries containing the remaining, concentrated radioactive material into a solid waste that may be shipped to approved storage sites so that no liquid radioactive waste is discharged to the environment.

All water-cooled nuclear power plants operating in the United States utilize variations of steps a through d for processing liquid process waste. Alternative step d' has not been commercially demonstrated in United States nuclear power plants to date but, as noted in testimony of Dr. Theos J. Thompson before the Joint Committee on Atomic Energy*, Sacramento Municipal Utility District plans to use this concept at its Rancho Seco Nuclear Power Plant in California. Step d' requires a more elaborate treatment system for the effluent liquids in the form of additional demineralizer and filter stages and increased storage tank capacity. This sytem will result in some increase in the quantity of solidified wastes to be shipped to approved burial depots and some increase in the load placed upon the plant gaseous waste handling system.

The processes for removal of radioactive materials from liquid waste include filtration, demineralization (ion exchange), centrifugation, evaporation (concentration), and chemical precipitation. Slurries from the evaporation process are formed into solid wastes by mixing them with concrete. The solidified mix is then shipped offsite in sealed drums. Storage of certain fractions of the waste over a period of time is also utilized to accomplish a reduction in radioactive levels through natural decay.

In-plant radioactive waste handling systems purposely separate lightly contaminated liquid waste from more heavily contaminated liquid waste in order to simplify later cleanup operations. For example, drainage from the primary coolant system is considered "clean" waste in that dissolved solids may average one ppm or less of dissolved solids. This drainage may be cleaned up relatively easily by filtration and demineralization and returned to the primary system. "Dirty" wastes from floor and sink drains which contain a higher concentration of dissolved solids are treated separately and cannot be demineralized economically.

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* - Ibid, pp. 156-157.

It may thus be seen that liquid waste cleanup in nuclear reactor power plants is accomplished by more or less standard industrial processes with discharge of diluted low level radioactive waste to the environment varying from plant to plant and ranging down to near zero.

The discussion to this point has centered upon water-cooled nuclear power plants. There is one gas-cooled nuclear power reactor operating in the United States: the Peach Bottom station is a 40-MWe station operated by Philadelphia Electric Company. A second 330-MWe gas-cooled nuclear power plant is the Fort St. Vrain facility under construction by the Public Service Company of Colorado.

Use of gas in place of water as the reactor coolant greatly reduces the amount of liquid wastes produced. Liquid waste treatment facilities at gas-cooled reactor plants are similar, in principle, to those of water-cooled reactors but the quantities processed are less.

BLOWDOWN FLOW FROM CONDENSER COOLING SYSTEM

Water must be bled from condenser cooling systems which employ evaporative-type cooling on a continuous or intermittent basis to maintain the concentration of dissolved solids below maximum limits. These limits are necessary to control fouling of heat exchanger surfaces.

The quantity of blowdown flow varies depending on whether evaporative cooling towers, cooling lakes or spray ponds, or a combination of these systems, is used for turbine condenser cooling. The quantity of blowdown flow also varies as a function of time of year: the proportion of heat that is discharged to atmosphere from the plant cooling system via evaporative heat transfer processes depends upon climatological conditions, and the amount of blowdown required to maintain dissolved solids content below maximum limits varies accordingly. Blowdown requirements also depend upon the purity of the makeup water supply to the condenser cooling system which may change during the year. If cooling ponds are used, leaching of chemicals from surrounding soils can occur and also influence the blowdown flow rate.

BLOWDOWN DISPOSAL

Various methods commonly used to dispose of blowdown are depicted in Figure 1.

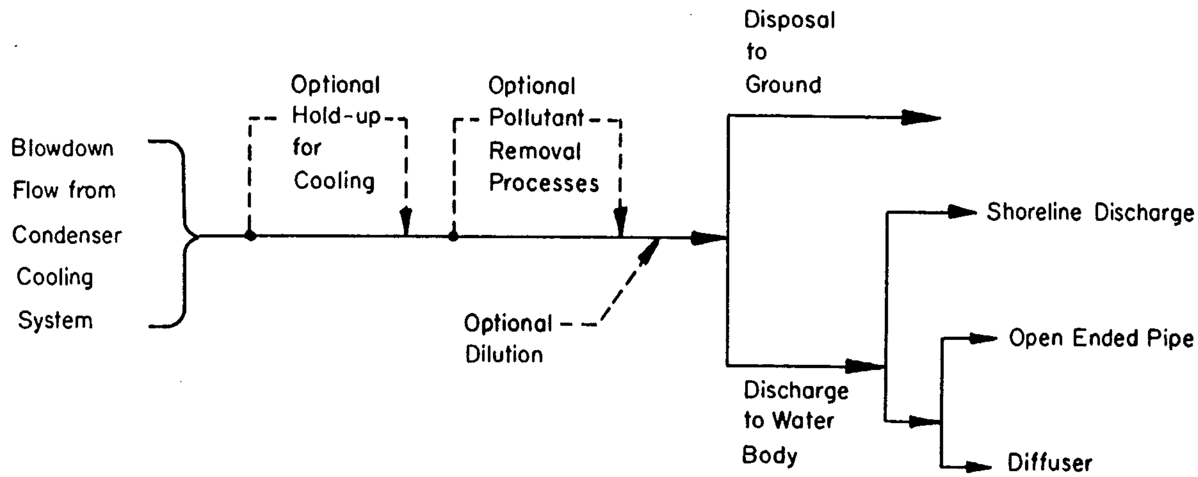


FIGURE I
ALTERNATIVES FOR BLOWDOWN DISPOSAL

Blowdown may be disposed of directly to nearby water bodies or by means of seepage ponds. Where soil conditions are favorable, pollutants carried in pond seepage may be partially scavenged from the waste stream by the soil.

Discharge of blowdown directly to nearby water bodies may be accomplished by shoreline discharge or discharge at depth in the receiving body. Discharge at depth may be accomplished using open-ended pipes or perforated pipes (diffusers), the latter being used to obtain more rapid mixing with the ambient water. In some cases, the blowdown flow may be diluted with fresh water before it flows back to the environment. Depending upon system design and purity of the receiving waters, a variety of process methods may be used, beyond simple dilution, to reduce pollutant concentration in the blowdown stream to an acceptable level. Holdup basins or ponds may also be used to obtain partial cooling of the blowdown before it is returned to the receiving water body.

CHEMICAL ADDITIVES

The type of evaporative cooling system employed and the purity of the condenser coolant makeup source have an important bearing on chemicals added to the process coolant to control scaling of heat exchanger surfaces, to control growth of biota, and to control system corrosion or deterioration. The additives selected, in turn, have a bearing on subsequent blowdown disposal methods.

The following Table I is a summary of chemical treatments employed in evaporative cooling towers*.

TABLE I

SUMMARY OF CHEMICAL TREATMENTS

Potential Problem	Factors	Causative Agents	Corrective Treatments
Wood Deterioration	Microbiological Chemical	Cellulolytic Fungi Chlorine Sodium Carbonate	Fungicides Acid
Biological Growths	Temperature Nutrients pH Innoculants Deposits	Bacteria Fungi Algae	Chlorine Chlorine Donors Organic Sulfurs Quatenary Ammonia
General Fouling	Suspended Solids Water Velocity Temperature Contaminants Metal Oxides	Silt Oil	Polyelectrolytes Polyacrylates Lignosulfonates Polyphosphates
Corrosion	Aeration pH Temperature Dissolved Solids Galvanic Couples	Oxygen Carbon Dioxide Chloride	Chromate Zinc Polyphosphate Tannins Lignins Synthetic Organics
Scaling	Calcium Alkalinity Temperature pH	Calcium Carbonate Calcium Sulfate Magnesium Silicate Ferric Hydroxide	Phosphonates Polyphosphates Acid Polyelectrolytes

* - From an article entitled "Chemical Treatment" by John M. Donohue, Betz Laboratories, which appeared in "Industrial Water Engineering", May 1970, pp. 35-38.

The table is a summary of chemical treatments for evaporative cooling towers but, with some qualification, contains information generally applicable to all evaporative cooling systems. The category on wood deterioration applies to older types of cooling towers which utilized wood as the material of construction. More recently, towers have been designed using concrete shells and ceramic or concrete filler materials. In these cases, there is no need for special additives in the coolant to control wood deterioration.

Evaporative-type cooling towers present a warm, moist environment that is ideal for microbiological growth and chemical additives are required for its control. The same applies to cooling ponds and the corrective treatments for biological growth shown in the table are generally applicable to cooling ponds and canals as well as towers.

All condenser cooling systems require treatment to control scaling, corrosion and general fouling of the kinds shown in the table. The particular additives required depend upon system design, makeup water quality and blowdown disposal limitations.

The additives necessary for corrosion control usually present the most difficult disposal problems. Additives required for control of fouling, scaling and biological growth are more easily dispersed to the environment at acceptable concentrations.

Chlorine gas, hypochlorites, and organic chlorine donors are commonly used as biocides in large cooling systems. The low concentration of chlorides necessary to produce effective biological control generally presents little or no problem for blowdown disposal, especially if the blowdown is diluted. Nonoxidizing biocides which are biodegradable are also available. The nonoxidizing biocides can be effectively treated by securing the blowdown for 8 to 12 hours following its addition to allow maximum degradation prior to release. In some instances effective use can be made of both chlorine and nonoxidizing biocides together.

Combinations of polyphosphates, chromates, and zinc are commonly used to inhibit corrosion in cooling systems. Particular attention must be paid to effluents which contain chromium and zinc. If the blowdown is highly diluted, it may be possible to obtain acceptable discharge concentrations of these heavy metals. However, if sufficient dilution is not available, it may be necessary to precipitate these metals for disposal as sludge or switch to other inhibitors such as tannins or a polar-organic sulfur compound. There are ion-exchange systems available which are capable of removing chromates and zinc from blowdown. The economy of ion-exchange removal of these ions is heavily dependent upon the concentration of other ions that may be present.

In general, the blowdown from cooling systems contains corrosion inhibitors, antifoulants and biocides as contaminants. Normally, these contaminants are not highly concentrated and may be effectively treated by diluting the blowdown before it is released. However, simple dilution may need to be supplemented with other processes in some cases.

This report has provided a summary description of state-of-the-art liquid waste treatment methods that appear relevant to the Hanford No. 2 plant. Specific plans and specifications for plant liquid waste disposal are discussed elsewhere in the License Application.

Respectfully submitted,

R. W. BECK AND ASSOCIATES

By Richard F. Corlett

(2) Quality.

(e) Make and submit a hydrographic study of temperature, salinity structure, and other physical factors in the receiving waters that may influence the dilution, dispersion and reconcentration of waste discharges.

The Project will use the Columbia River as a source of cooling water makeup for cooling tower losses.

Physical factors of the river include minimum, maximum and average temperatures and flow rates.

A considerable amount of research, prediction and recording has been accomplished on the Columbia River temperatures in the Hanford reach. Statutory controls have included the Federal Water Quality Act, the State of Washington Water Quality Standards for Intrastate Waters by the Water Pollution Control Commission, Water and Environmental Quality Improvement Act and the National Environmental Policy Act.

Washington State standards for the Columbia River from the Washington-Oregon border (River Mile 309) to Priest Rapids Dam (River Mile 397) categorize this reach as Class A and among other criteria stipulate temperature requirements. No measurable increases shall be permitted within the waters designated which result in water temperatures exceeding 68°F., nor shall the cumulative total of all such increases arising from nonnatural causes be permitted in excess of t=110/ (T-15) with the "t" the permissive increase and "T" the resultant water temperature.

Table 025.2e-1 includes 1960-1968 average and extreme monthly temperatures and 1969 average and extreme monthly temperatures at Priest Rapids Dam at a point 47 miles upstream from the Site. Graphical illustration of 1953-1967 temperatures is shown by figure 025-4.

TABLE 025.2e-1

Columbia River Temperatures
at
Priest Rapids Dam

	FLOW RATE (KCFS)			TEMPERATURE (°C)						
							1969 Extremes		1960-68 Extremes	
	1969 Avg	1953-1967 Avg	1969 % of 15 Yr. Avg	1969 Avg.	1960-1968 Avg	Departure	High	Low	High	Low
J	104	71	147	2.5	5.0	-2.5	3.8L	0.0L	7.6	1.8
F	115	78	148	1.5	4.1	-2.6	2.4L	0.0L	6.2	2.2
M	108	79	137	3.4	4.5	-1.1	5.6	1.9L	6.9	2.0
A	184	104	177	7.2	7.0	+0.2	8.4	5.3	10.0	4.3
M	231	205	113	10.8	10.3	+0.5	13.1H	8.1	13.0	7.5
J	239	347	69	14.6	13.3	+1.3	15.9H	12.3	15.4	11.0
J	190	246	77	17.1	16.1	+1.0	19.0	15.4H	19.2	13.1
A	101	123	82	18.2	17.9	+0.3	19.7	17.1	19.9	15.8
S	76	82	93	17.7	17.5	+0.2	19.1	16.3	19.7	15.3
O	82	72	114	14.8	15.0	-0.2	17.1	13.5	18.7	12.3
N	89	70	127	11.5	11.3	+0.2	14.5H	8.6	14.4	8.2
D	97	67	145	7.6	7.4	-0.2	9.2	6.0	10.5	2.3
Y	135	129	105	10.6	10.8	-0.2	19.7	0.0	19.9	1.8

H - Record high since 1960. L - Record low since 1960.

(2) Quality.

(e) Make and submit a hydrographic study of temperature, salinity structure, and other physical factors in the receiving waters that may influence the dilution, dispersion and reconcentration of waste discharges.

The Project will use the Columbia River as a source of cooling water makeup for cooling pond losses.

Physical factors of the river include minimum, maximum and average temperatures and flow rates.

A considerable amount of research, prediction and recording has been accomplished on the Columbia River temperatures in the Hanford reach. Statutory controls have included the Federal Water Quality Act, the State of Washington Water Quality Standards for Intrastate Waters by the Water Pollution Control Commission, Water and Environmental Quality Improvement Act and the National Environmental Policy Act.

Washington State standards for the Columbia River from the Washington-Oregon border (River Mile 309) to Priest Rapids Dam (River Mile 397) categorize this reach as Class A and among other criteria stipulate temperature requirements. No measurable increases shall be permitted within the waters designated which result in water temperatures exceeding 68° F., nor shall the cumulative total of all such increases arising from nonnatural causes be permitted in excess of $t=110/(T-15)$ with the "t" the permissive increase and "T" the resultant water temperature.

Table 025.2e-1 includes 1960-1968 average and extreme monthly temperatures and 1969 average and extreme monthly temperatures at Priest Rapids Dam at a point 47 miles upstream from the Site. Graphical illustration of 1953-1967 temperatures is shown by Figure 025-4.

TABLE 025.2e-1

Columbia River Temperatures
at
Priest Rapids Dam

	FLOW RATE (KCFS)			TEMPERATURE (°C)						
							1969 Extremes		1960-68 Extremes	
	1969 Avg	1953-1967 Avg	1953-1967 Avg	1969 Avg	1960-1968 Avg	Departure	High	Low	High	Low
J	104	71	147	2.5	5.0	-2.5	3.8[L]	0.0[L]	7.6	1.8
F	115	78	148	1.5	4.1	-2.6	2.4[L]	0.0[L]	6.2	2.2
M	108	79	137	3.4	4.5	-1.1	5.6	1.9[L]	6.9	2.0
A	184	104	177	7.2	7.0	+0.2	8.4	5.3	10.0	4.3
M	231	205	113	10.8	10.3	+0.5	13.1[H]	8.1	13.0	7.5
J	239	347	69	14.6	13.3	+1.3	15.9[H]	12.3	15.4	11.0
J	190	246	77	17.1	16.1	+1.0	19.0	15.4[H]	19.2	13.1
A	101	123	82	18.2	17.9	+0.3	19.7	17.1	19.9	15.8
S	76	82	93	17.7	17.5	+0.2	19.1	16.3	19.7	15.3
O	82	72	114	14.8	15.0	-0.2	17.1	13.5	18.7	12.3
N	89	70	127	11.5	11.3	+0.2	14.5[H]	8.6	14.4	8.2
D	97	67	145	7.6	7.4	-0.2	9.2	6.0	10.5	2.3
Y	135	129	105	10.6	10.8	-0.2	19.7	0.0	19.9	1.8

H - Record high since 1960. L - Record low since 1960.

Chemical wastes from Hanford No. 2 will have no measurable effect on the environment. Corrosion products and some chemcial wastes will be incorporated with the radioactive solid wastes that are disposed of by burial.

Chemical discharges consist of the return to the river of dissolved salts in water taken from the Columbia River and evaporated in the cooling tower system, of sulfate salts formed when the normally alkaline river water is neutralized of trace amounts of chlorine used to inhibit formation of algae and slime, of sand scrubbed from the air by the cooling tower system, and of salts released by regeneration of demineralizer resins used to treat well water.

Hanford No. 2 will use an evaporative cooling tower system as the heat sink for the plant. Water will be pumped from the Columbia River to make up for losses from the cooling towers due to evaporation, drift and blowdown. Evaporation of a portion of the water will increase the concentration of total dissolved solids (TDS) in the tower water to a value higher than that normally found in the river. The concentration factor, i.e., the ratio of the concentration in the tower water to that in the river, is equal to the ratio of the makeup rate to the non-evaporative loss rate. The blowdown rate from the cooling tower will be at least 1500 gpm. With a maximum evaporation rate approximately 15,000 gpm, and disregarding the contribution by drift, the maximum concentration factor will be no greater than 10.

Sulfuric acid will be added to the tower water to reduce the pH of the normally alkaline water to between seven and eight. For normal river water quality, this addition will be about eight ppm. The sulfuric acid reacts primarily with carbonates in the water to form sulfate salts. The TDS in Columbia River water normally ranges from 75 to 115 ppm. The TDS of tower water will normally be increased less than 10% by neutralization of the alkalinity in the river water. The maximum TDS in the blowdown water returning to the Columbia River will normally be less than 1000 ppm, since blowdown rates can be increased when the TDS in the river is high.

Chlorine will be added to the circulating water at the inlet to the condenser to control algae and slime. The chlorine will be added two or three times a day for periods of about 20 minutes. During this time the chlorine content of the water going to the cooling tower will be about 0.5 ppm, but most of this will be dispersed to the atmosphere during passage through the tower. The chlorine content of blowdown water will at all times be less than 0.1 ppm.

During dust storms on the Hanford Reservation the cooling tower system will act as a giant air cleaner. Most of the windblown sand will settle out in the basin at the base of the tower, but the supernatant water may have a high concentration of suspended silica fines during these periods. Since this water will still be used as condenser cooling water it is believed that the tower water turbidity, and the turbidity of the blowdown, will be less than 100 Jackson Turbidity Units even during severe dust storms.

In addition to the chemical effects discussed above it is planned to remove excess liquid inventories by periodic injection into the blowdown line. A more detailed discussion of these releases is presented in SECTION 025 (2g). The plant will use wells as a source of potable water and makeup for the reactor cooling water. After initial inventories have been accumulated, the rate of consumption of well water will be less than 15 gpm. This water is passed through demineralizers before use. If the rate of use were as high as 15 gpm, most of the demineralizers would have to be regenerated about every 10 days, and some would be regenerated once a month. Regeneration of demineralizer resins will cause the release of the following chemicals in amounts less than those indicated, after the plant is in normal operation.

Sodium sulfate	-	900	lbs.	per	month
Calcium sulfate	-	650	"	"	"
Sodium carbonate	-	550	"	"	"
Magnesium sulfate	-	200	"	"	"
Sodium chloride	-	6	"	"	"
Sodium nitrate	-	0.2	"	"	"

By contrast, if water containing 100 ppm of dissolved solids is withdrawn from the river and evaporated at an average rate of 10,000 gpm, the dissolved solids in this water will be returned to the river at a rate of 360,000 lbs. per month. It is concluded that the total amount of dissolved solids introduced to the river from demineralization of reactor water makeup is small compared to the amount of dissolved solids naturally present in the river water which is returned to the river with the blowdown.

With a dilution factor of at least 3000, the chemical effect on the river of Hanford No. 2 blowdown due to an increase in TDS will be unmeasurable.

A discussion of the radiological discharges and characteristics thereof is included in SECTION 015(4).

Physical characteristics of the Columbia River opposite the location of the intake and outfall structure consists of a channel approximately 3,000 feet wide, depending on flow, and is illustrated by the photograph entitled "View of Hanford No. 2 Site Looking Southwest Across The Columbia River From White Bluffs". Approximately half of the total channel width is occupied by an island diverting the main channel flow to the west channel. This main channel of the river is less than 500 yards wide and the velocity in the main channel varies between two and five cfs depending upon flow quantity. The water is turbulent, with minor stratification since the pool upstream from McNary Dam (River Mile 292) has little effect upon the river near River Mile 351.5.

Battelle prepared an October 1970 report on the lateral and longitudinal eddy diffusion coefficients for the section of the river between River Miles 383 and 355.[3]

The intake and outfall facilities will be located in a stretch of the river (351 - 352) that is a relatively straight channel with no significant embayments or shoreline obstructions. Eddy currents in this reach of the river are limited to those caused by minor river bed irregularities and turbulence caused by the free flowing nature of the river. Cross sections of the river bed, showing the river bottom contour and depth at a minimum flow of 36,000 cfs, is illustrated by Figure 025-12.

(2) Quality.

(f) Provide background water quality data pertinent to the site in question.

The main stem of the Columbia River shows little change in mineralization from the International Boundary to the point of its confluence with the Snake River. The effect of incoming tributaries with higher mineralization is partly offset by the contribution of tributaries with lower mineralization. However, the major reason for the uniformity of mineralization in this stretch of the main stem is the relative discharge of the Columbia River compared to that of its tributaries. The average flow of the largest tributary, Spokane River, is less than 10 percent of the average flow of the Columbia River at Pasco.

The Columbia River as it enters the United States from Canada has a calcium bicarbonate type water which has an average dissolved-solids concentration of approximately 90 mg/l (milligrams per liter). Samples collected daily at the International Boundary (Northport, Washington) since 1952 have had a dissolved-solids range of 71-158 mg/l. The water is moderately hard, ranging from 62 to 128 mg/l hardness. At River Mile 385 the dissolved-solids range is 75-104 mg/l, and the hardness range 62-81 mg/l.

Water temperatures range on the average at Priest Rapids from 4°C to 18°C, with a low in February-March and a high in August. A phase shift caused by upstream reservoirs has in recent years caused a shift in peak temperatures toward the fall months. High temperatures of 21.5°C were observed during the high year of record 1958.

Dissolved oxygen concentrations are routinely near saturation. Occasional dips do occur seasonally, but do not constitute any significant impairment of water quality. Oxygen levels near the study area range from 9.5 to 14.0 mg/l, with a mean of 11.8 mg/l.

Coliform organisms average 131MF/100 ml in the reach below Priest Rapids Dam; the observed range is from 0 to 430MF/100 ml. The average river temperature for 1969 was slightly below the 1960-68 mean. Although record low temperatures occurred in each of the first three months, the deficiency was nearly offset by the above-normal averages of May through July and by near-normal averages during April and August through December.

A water analysis report conducted by Douglas United Nuclear Inc., in the Columbia River at the Hanford Reservation is summarized in Table 025(2f)-1.

Trace amounts of other matter are also transported by the Columbia River, but are of such minor significance, compared to the items in Table 025(2f)-1, they are not routinely measured. An example of such trace elements is raw uranium, which Douglas United Nuclear reports is approximately 240,000 lbs. per year measured upstream from the Hanford Reservation.

TABLE 025(2f)-1

CHEMICAL CHARACTERISTICS OF COLUMBIA RIVER WATER[1]

(Values in ppm)

Item	Maximum	Minimum	Average
Calcium (Ca)	32	18	23
Magnesium (Mg)	6.7	1.9	4.2
Iron (Fe)	0.220	0	0.038
Sulfate (SO_4)	28	10	15
Chloride (Cl)	0.66	0.17	0.38
Nitrate (NO_3)	0.67	0	0.21
Phosphate (PO_4)	0.10	0	0.03
Copper (Cu)	0.05	0	0.006
Oxygen (O_2)	17.22	7.36	10.59
Chromate (Cr^{+6})	6.014	0	0.007
PHTH ALK (as $CaCO_3$)	5	0	2
M.O. ALK (as $CaCO_3$)	76	41	63
Hardness	88	64	74
Dissolved Solids	115	72	87

[1] Data from Douglas United Nuclear, Inc. - July 8, 1969 to June 16, 1970

(2) Quality.

(g) Provide a plan for pre- and post-operation water quality monitoring to insure the maintenance of water quality standards and continued beneficial uses of adjacent waters.

Water temperature, chemistry and radiological monitoring will be conducted at intervals depending upon the information required to assure compliance with applicable water quality standards. Certain monitoring, such as water temperature measurement, will be performed continuously in conjunction with operational requirements of the Project. Periodic samples collected at points where concentrations of effluents in the environment are expected to be greatest, will be compared with samples collected concurrently at points unaffected by the Project. Comparisons of samples will provide a basis for distinguishing any measurable effects.

Water quality of the Columbia River and the groundwater in the Site vicinity will be monitored in conjunction with the appropriate portions of the environmental radiation monitoring program described in the response to Section 015(4).

The treatment of liquid wastes is concerned principally with keeping the release of radioactivity as low as practicable. Hence, the system is known as the "liquid radwaste system".

The liquid radwaste system collects, monitors, processes, stores and disposes of all radioactive liquid wastes. Included in the liquid radwaste system are the following:

a. Piping and equipment drains carrying potentially radioactive wastes

b. Floor drain systems in controlled access areas and/or those areas which may contain potentially radioactive wastes

c. Tanks and sumps used to collect potentially radioactive wastes

d. Tanks, sumps, piping, pumps, process equipment, instrumentation and auxiliaries necessary to process, store and dispose of potentially radioactive wastes.

Equipment is selected, arranged, and shielded to permit operation, inspection, and maintenance with acceptable personnel exposures. For example, sumps, pumps, valves and instruments are located in controlled access areas. Tanks and processing equipment which can contain large quantities of liquid radwaste are shielded. In addition, equipment is selected for a minimum of maintenance. The radwaste system equipment, equipment arrangement, and flow paths are given in Figure 025-5. Operation of the waste system is essentially manual start-automatic stop.

Protection against accidental discharge is provided by design redundancy, instrumentation for detection and alarm of abnormal conditions, and procedural controls. The radwaste facility arrangement and the methods of waste processing provide a substantial degree of immobility of the wastes within the plant. This assures that in the event of a failure of the liquid waste system, or errors in operation of the system, the potential for inadvertent release of liquids is small.

Immobility of wastes is further accomplished by collecting solids on filters and demineralizer resins. The filter sludges and spent resin are processed and packaged by the solid radwaste system.

The liquid radwaste system is divided into several subsystems so that the liquid wastes from various sources can be kept segregated and processed separately. Cross connections between the subsystems provide additional flexibility for processing of the wastes by alternate methods. The liquid radwastes are classified, collected, and treated as high purity, low purity, chemical, detergent, sludges or concentrated wastes. The terms high purity and low purity refer to the conductivity and not radioactivity.

High Purity Liquid Wastes

High purity (low conductivity) liquid wastes are collected in the waste collector tank from the following sources:

Drywell equipment drain sump

Reactor building equipment drain pump

Radwaste equipment drain pump

Turbine building equipment drain sump

Reactor cleanup system

Residual heat removal (RHR) system

Cleanup phase separators

Fuel pool system

The high purity wastes are processed by filtration and ion exchange through the waste filter and waste demineralizer. After processing, the waste is received in a waste sample tank where it is sampled and then, if satisfactory for reuse, transferred to the condensate storage tank as makeup water.

If the analysis of the sample reveals water not meeting specification for reuse it is returned to the system for additional processing by the waste filter--demineralizer train. On infrequent occasions, water meeting 10CFR20 limits for disposal after dilution may be discharged to accommodate station water inventories.

Low Purity Liquid Wastes

Low purity (high conductivity) liquid wastes are collected in the floor drain collector tank from the following sources:

Drywell floor drain sump

Reactor building floor drain sumps

Radwaste facility floor drain sumps

Turbine building floor drain sump

Waste sludge phase separator

These wastes generally have low concentrations of radioactive impurities; processing consists of filtration, ion exchange, and subsequent transfer to the floor drain sample tank for sampling and analysis. Normally, low purity waste is routed to condensate storage for reuse in the plant. Alternately, water meeting 10CFR20 limits for disposal after dilution may on rare occasions be discharged to the discharge canal. Such discharges normally would be to accommodate station water inventories or because of quality below that required for reuse.

Chemical Wastes

Chemical wastes collected in the chemical waste tank are from the following sources:

Shop decontamination solutions

Reactor and turbine building decontamination drains

These chemical wastes are of such high conductivity as to preclude treatment by ion exchange. The radioactivity concentrations are variable and substantially affected by the infrequent decontamination solutions. To account for these chemical impurity problems, the chemical wastes will be purified by evaporation prior to ion exchange treatment. Subsequent to this purification step, the chemical wastes will be treated in the same manner as low purity liquid wastes, described above. Concentrates resulting from the evaporation step will be processed through the solid radwaste system.

Detergent Wastes

Detergent wastes are collected in the detergent tanks. These wastes consist of decontamination solutions which contain detergents and laboratory drains. They are of low radioactivity concentration. Because of a tendency to foul ion exchange resins, these liquid radwastes are kept separate.

Detergent wastes are routed to an evaporator with eventual discharge to the solid radwaste system.

Sludges

Expended ion exchange resins from the filter demineralizers are removed when necessary by back washing. Cleanup system sludges are collected in phase separators where excess backwash water is decanted to the waste collector tank and the sludge is accumulated. The fuel pool filter demineralizer and waste filters are backwashed to the waste sludge tank. The accumulated resins and sludges are processed through the solid radwaste system after a suitable decay period.

Means to be Employed to Keep Activity Discharges As Low as Practicable

Radwastes are received and processed in the sub-systems described. To insure operability of each of these systems so the wastes are processed by the treatment methods provided, the following system features are included.

1. Processing equipment is designed and selected so maintenance requirements are minimized and shielded

so maintenance can be done without interference with operations of other sub-systems.

2. Floor drain and waste filters and demineralizers are cross-connected so each filter or demineralizer may be used in place of the other if necessary to maintain process continuity.

3. Major liquid sub-system pumps are cross connected for maintainability such that outage of a pump does not impair sub-system continuity.

4. Since the sub-systems are batch systems rather than continuous and are preceded by collection tanks, time is available to accumulate wastes during maintenance of subsequent equipment or during filter backwashing and resin replacement. The waste surge tank is also provided to accumulate certain wastes and thus provide time for maintenance.

5. Certain operations are subject to scheduling and can be delayed in the event of mechanical problems. Examples are:

a. transfer from cleanup phase separators to waste collector and for solid waste processing

b. transfer to and from the waste sludge tank and spent resin rank

c. centrifuging operations (an installed spare centrifuge and hopper is also available)

d. drumming operations can be delayed; however, drumming of solid wastes is out of the path of usual waste water process.

e. Steam cleaning connections are provided for waste and floor drain filters so in-place cleaning can be performed in about three hours. Outage of these filters for their most common problem (cleaning of filter elements) is thus minimized.

f. Filter backwashing and precoating is part of the normal operating procedure for which cycle time has been allowed in the design.

g. Waste and floor drain demineralizer resin replacement is an infrequent operation, normally monthly to bi-monthly. The essential factor to minimizing outage time is to maintain an appropriate resin inventory at the station for resin replacement. Resins can be replaced in less than a shift, the major task being handling of resins from oncontainer to demineralizer.

The principal administrative areas involved in maintaining an operational system are daily planning of radwaste processing, control of the station water inventory, and the carrying out of a preventive maintenance program.

Radwaste system planning is to be done to assure that wastes are processed in a timely manner to assure that station operations and maintenance activities (draining, flushing, decontamination, etc.) are coordinated, so as not to impose unusual, unexpected quantities of water upon the radwaste system.

Control of the station water inventory is done to minimize the necessity for discharging waste water because of excessive inputs via the makeup system. Both the planning and water inventory control activities also are useful in detecting abnormal inputs to radwaste and thus revealing causes of such inputs for correction.

The preventive maintenance program has the obvious objective of minimizing unplanned equipment conditions which would affect radwaste performance. The cross connections noted above are available to accommodate such outages in critical flow paths.

The effluent from the plant to the discharge system, all of which must pass through one of two discharge tanks, is monitored by taking batch samples, and records are kept of the concentration levels. A process monitoring system is provided to indicate excessive radiation levels in the liquid discharge system. Upon the annunciation of the radiation level alarm, the discharge of the liquid radwastes is stopped automatically.

The processing equipment is located within concrete buildings, trenches, or cells to provide secondary enclosures for the wastes in the event of leaks or overflows. Tanks and equipment which contain wastes with high radioactive concentrations are shielded. Except where flanges are required for maintenance, all pipe connections are welded to reduce the probability of leaks. Process lines which penetrate shield walls are routed to prevent a direct radiation path from the tanks or equipment for which shielding is required. Control of the waste system is from a local panel convenient to the waste facility main area.

Sanitary wastes (not part of the liquid radwaste system) during plant operations will be processed by septic tank and fluids will be disposed of by means of a tile field similar to tile fields presently in operation on the Hanford Reservation. Chlorination equipment will be provided if found necessary. During construction, the same tile field septic tank system will be utilized supplemented by local individual chemical toilets in areas of work concentration. The entire system will conform to Washington State laws regulating the installation of sanitary facilities.

<u>*WAC 463-12-025 (2)(g)*</u> - *QUALITY OF THE ENVIRONMENT - WATER*
(Supp. filing 11/12/71)

Pre-operational water quality monitoring will include measurements and samples taken to assure that the construction activity required to install the intake, outfall and barge unloading facility are done in a manner so as to minimize scour, erosion, runoff and turbidity.

Background water quality is defined in Section 025 (1)(c) and Section 025 (2)(f). Compliance with regulations relating to the water quality standards is contained in Section 025 (1)(a). In addition to the environmental monitoring program procedure for sampling, measurement and testing contained in Section 015 (4), the Supply System will coordinate with the Council the method to be adopted in furnishing water quality monitoring data to be obtained from Hanford No. 2 instrumentation. Continuous recorders will be used to record river water temperature, makeup flow, blowdown flow, blowdown temperature and any other measurements required to assure compliance with the water quality standards of the State of Washington.

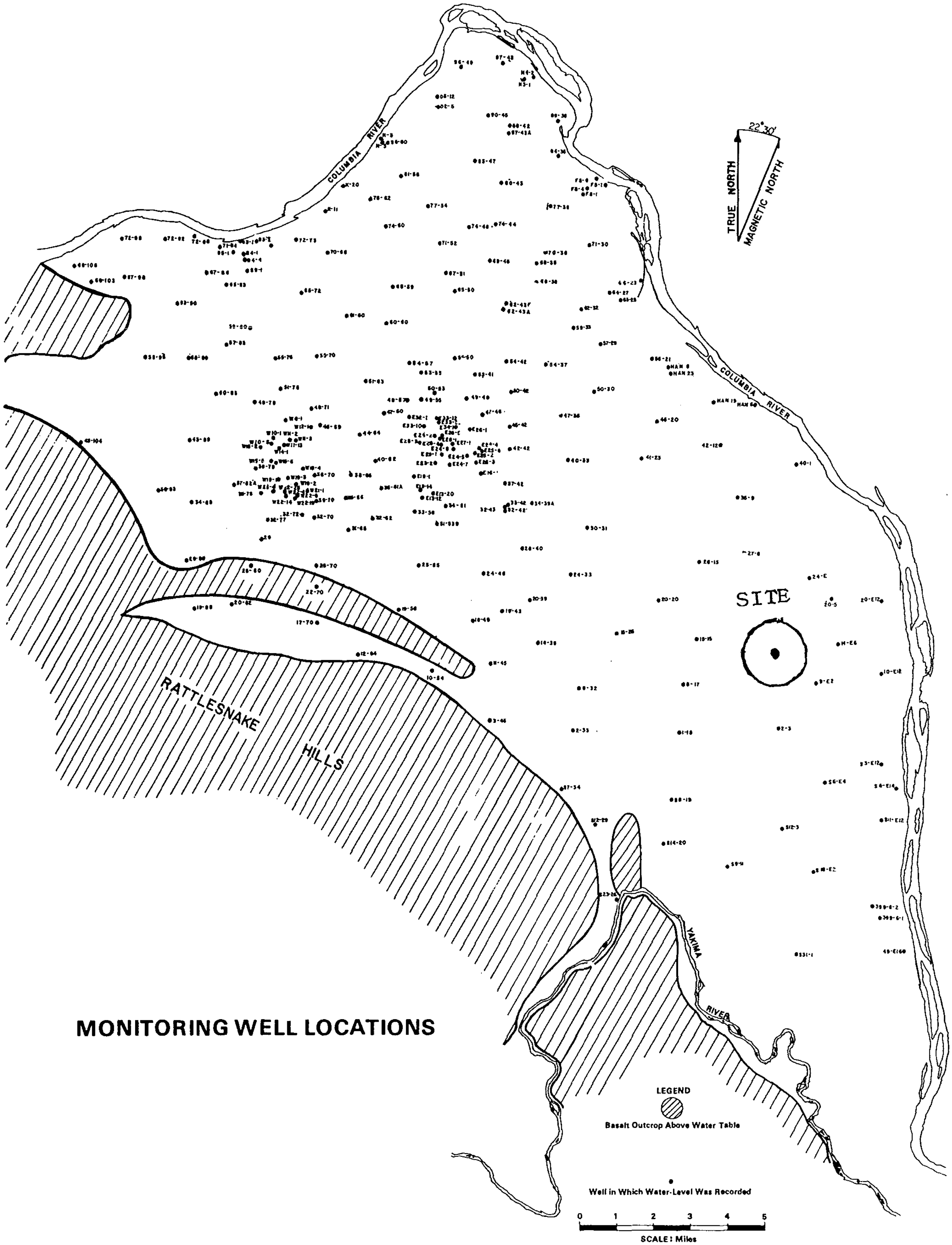
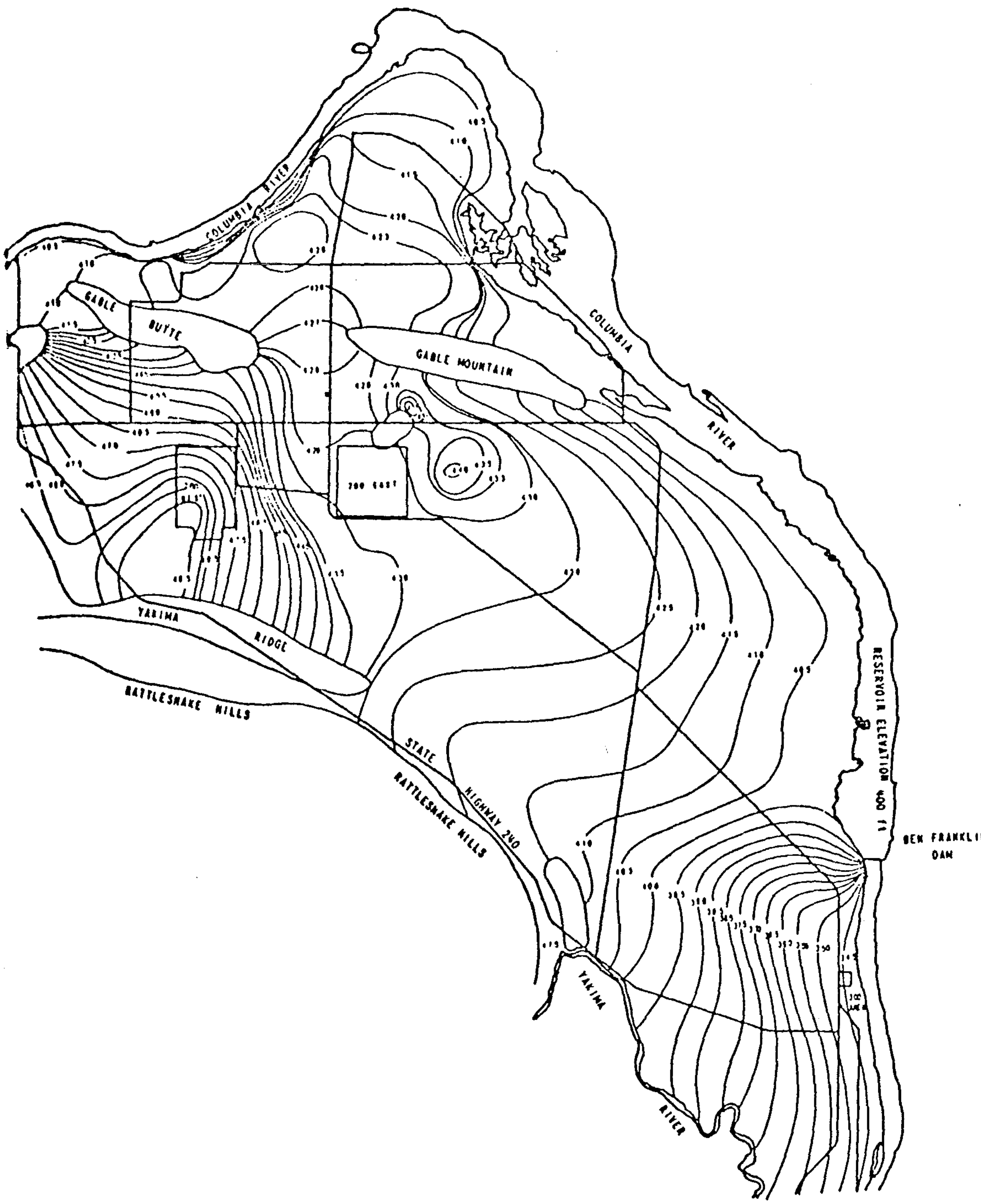

MONITORING WELL LOCATIONS
COLUMBIA RIVER
RATTLESNAKE HILLS
YAKIMA RIVER
SITE
TRUE NORTH
MAGNETIC NORTH
22°30'
LEGEND
Basalt Outcrop Above Water Table
Well in Which Water-Level Was Recorded
0 1 2 3 4 5
SCALE: Miles

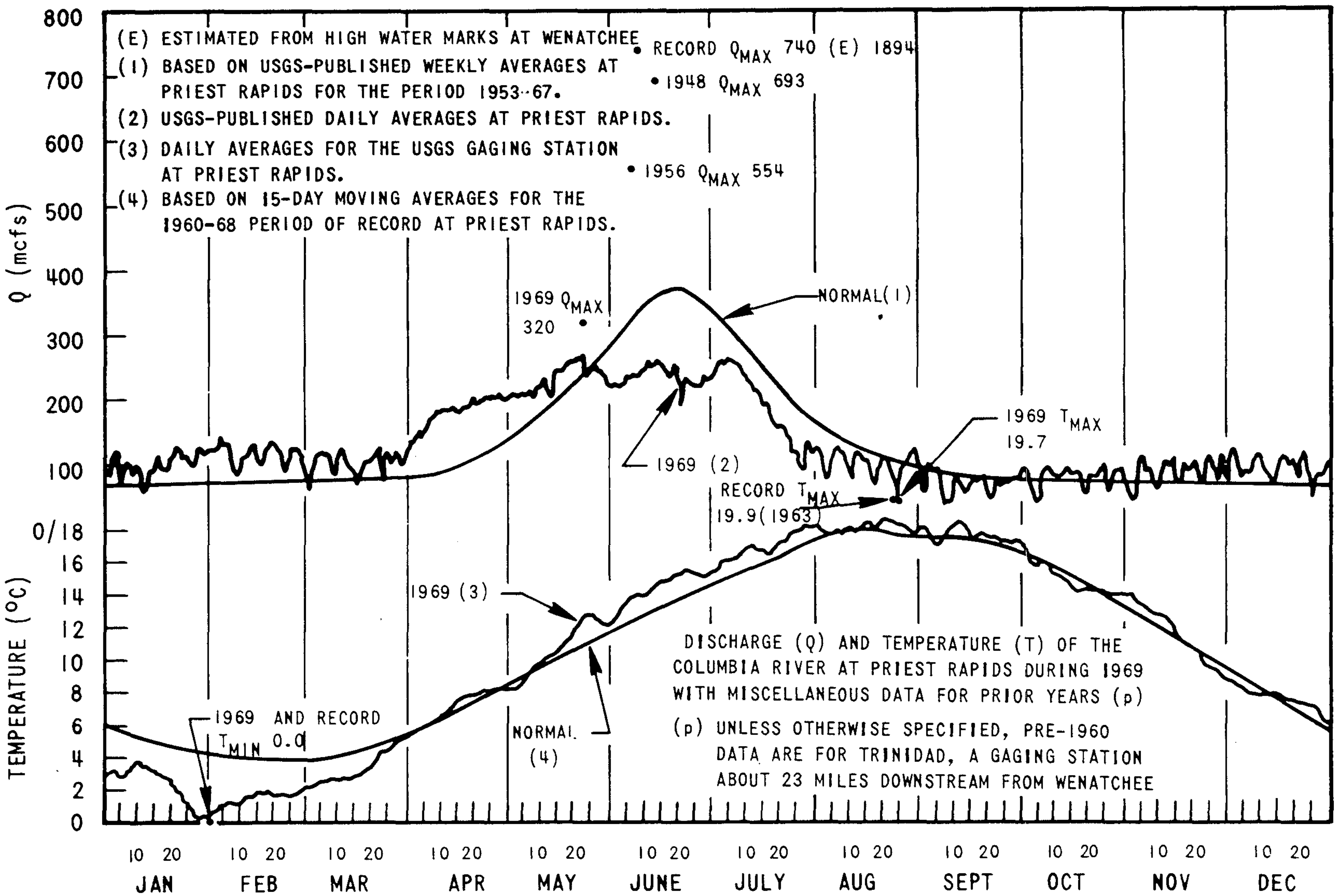
Figure 025-2



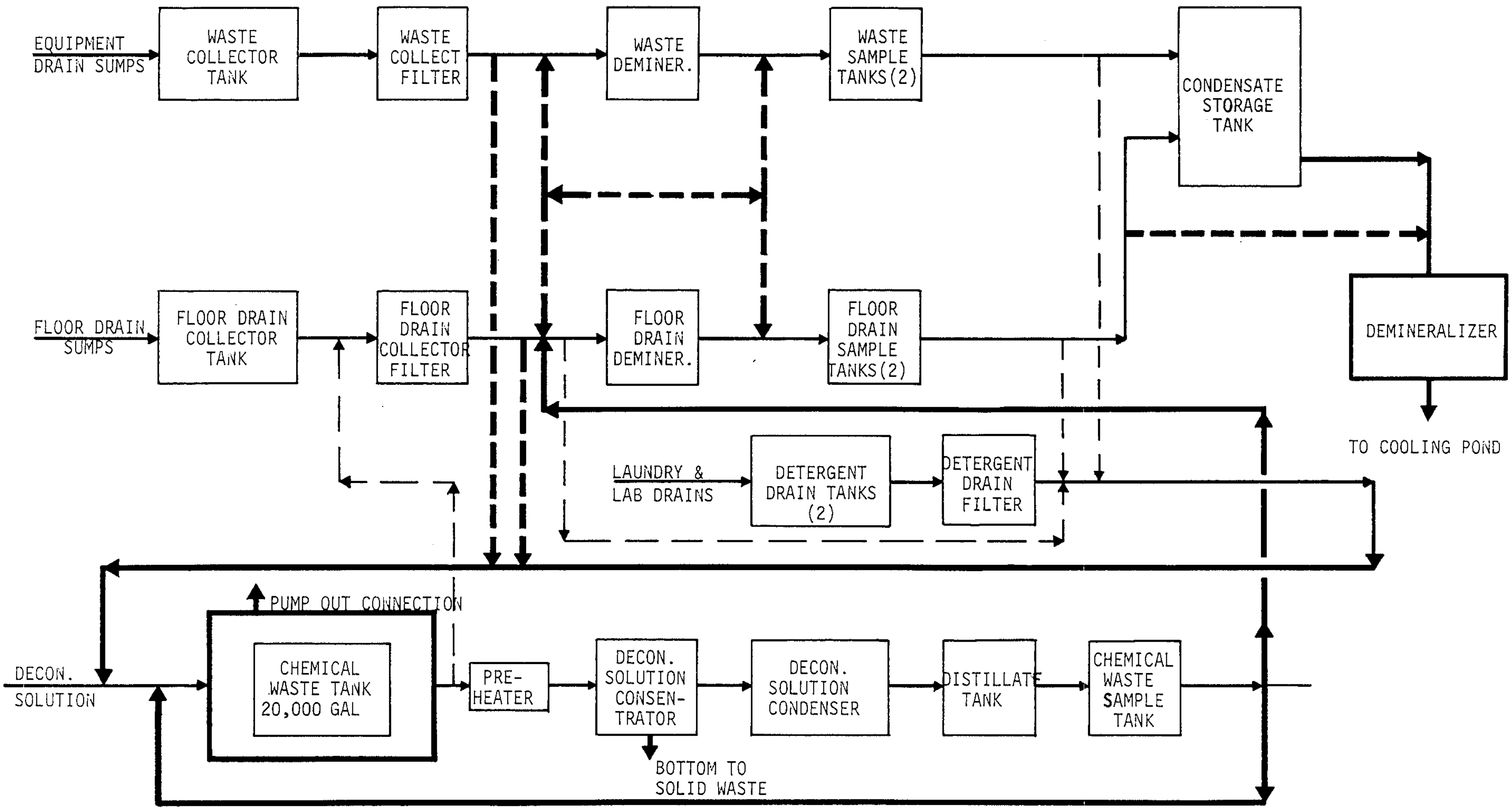
Groundwater Contours
of the
Hanford Reservation

Figure 025-3

Figure 025-4

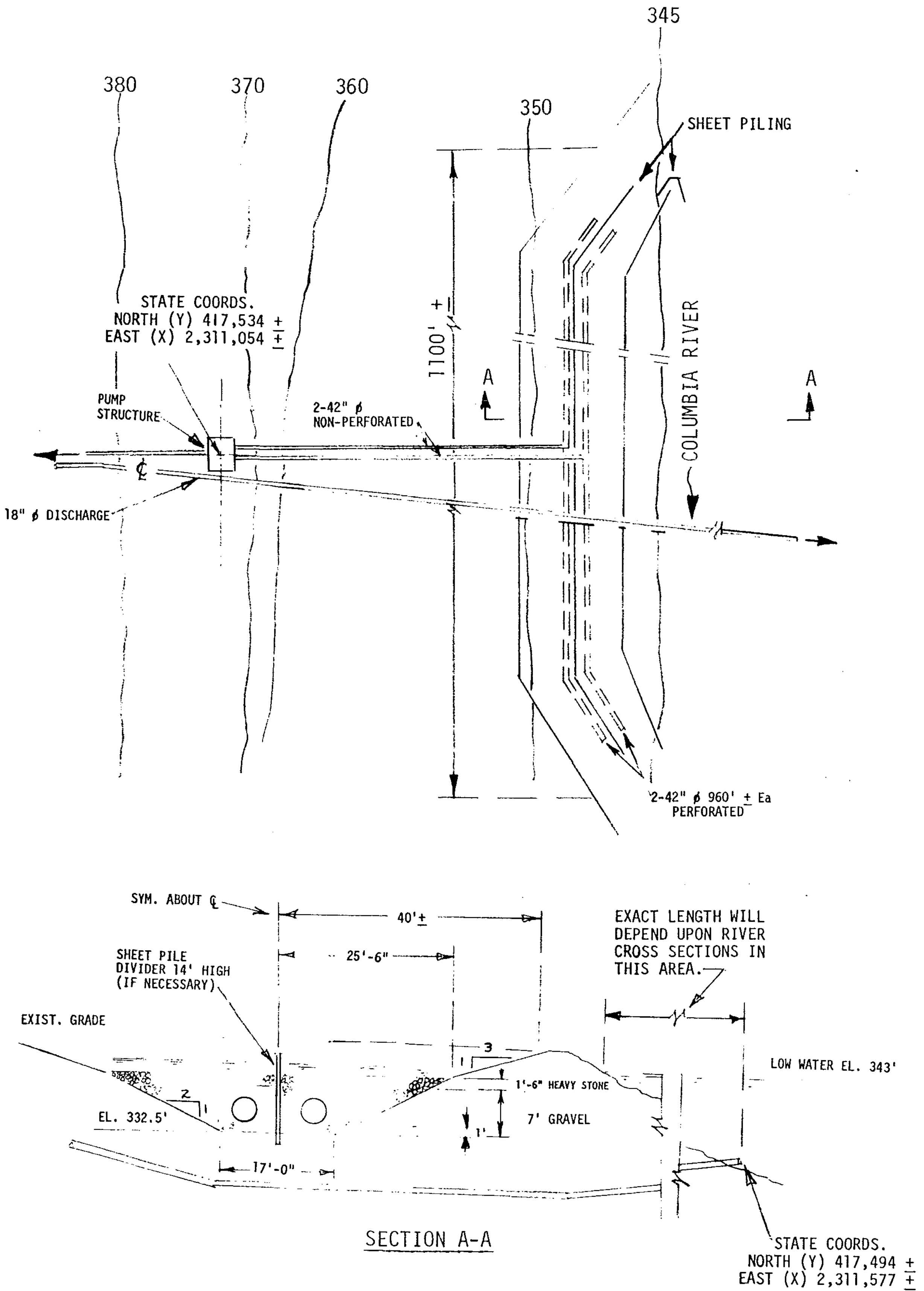


Discharge and Temperature of the Columbia River at Priest Rapids During 1969 with Miscellaneous Data for Prior Years



HANFORD NO. 2 LIQUID SYSTEM DESCRIPTION

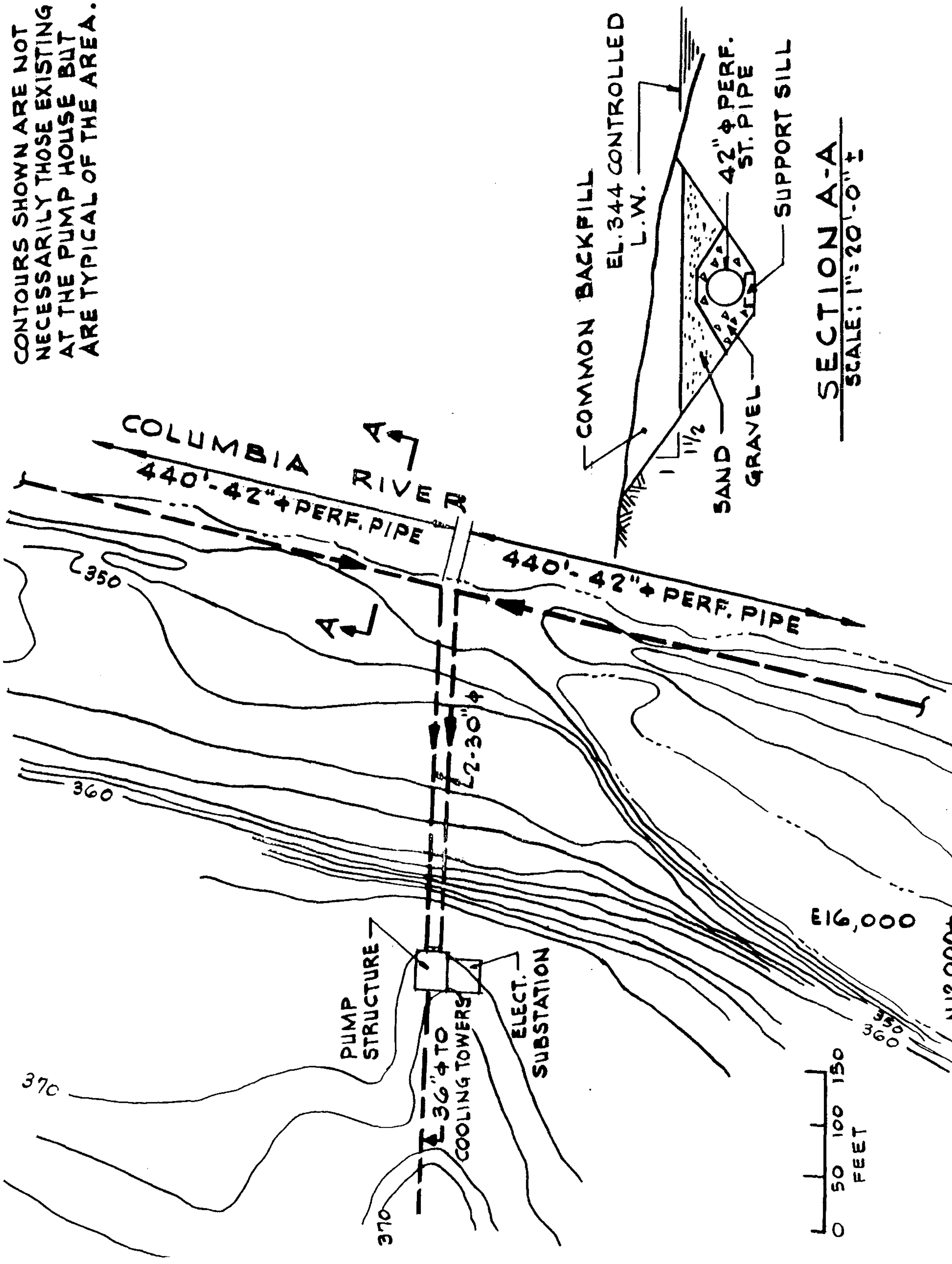
Figure 025-5



PRELIMINARY (NOT TO SCALE)

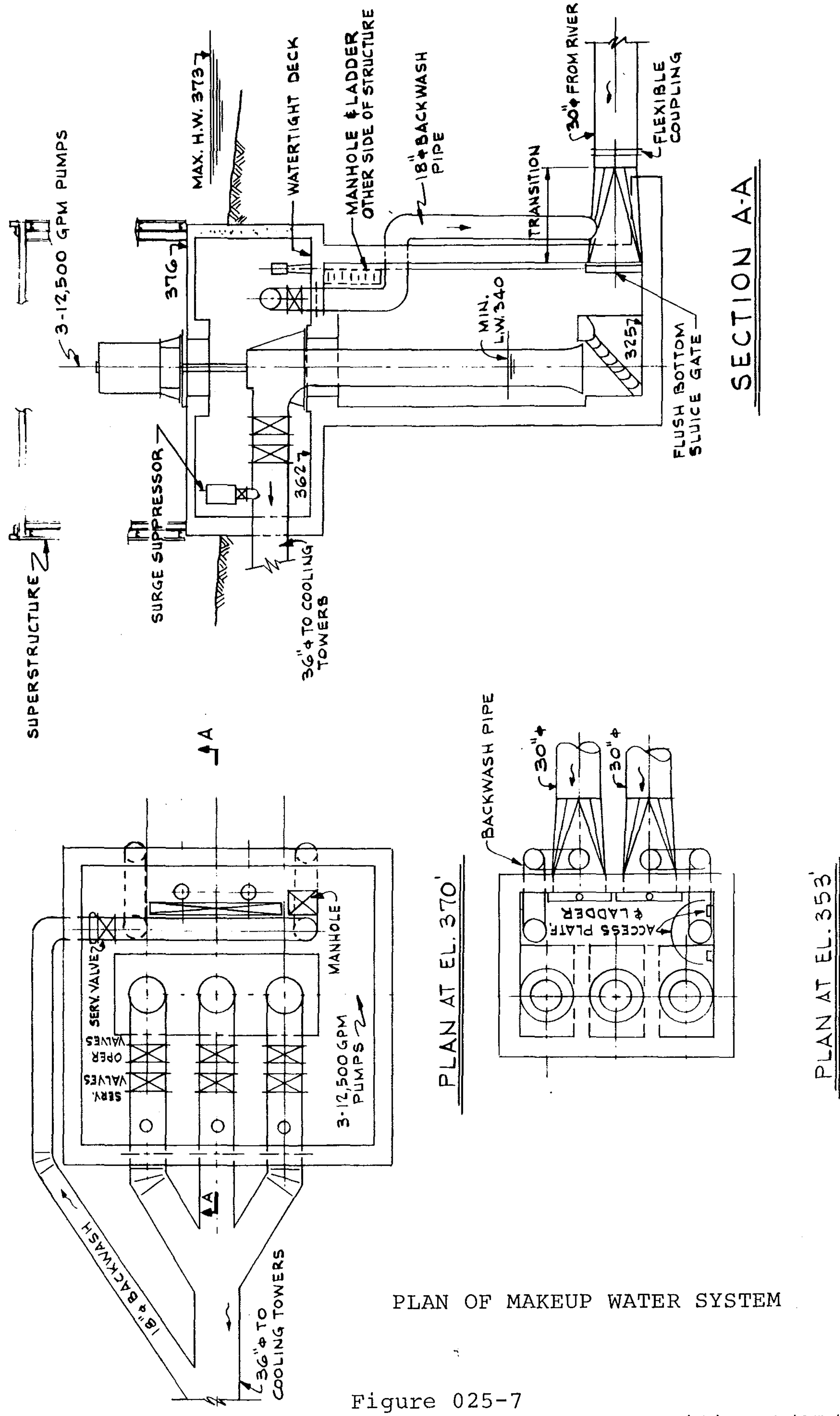
INFILTRATION AND DISCHARGE SCHEME

Figure 025-6



PLAN OF MAKEUP WATER SYSTEM

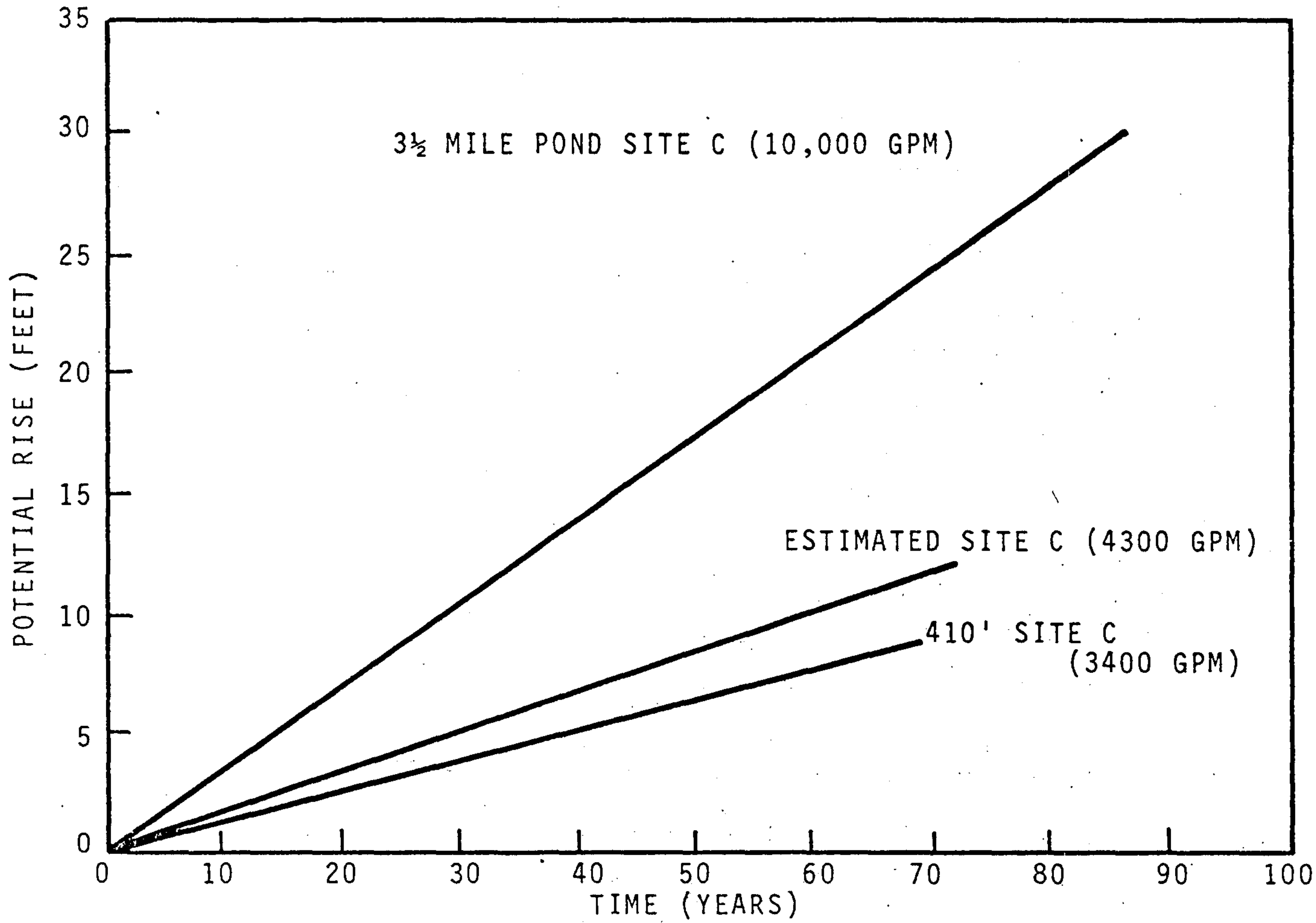
Figure 025-6



PLAN OF MAKEUP WATER SYSTEM

Figure 025-7

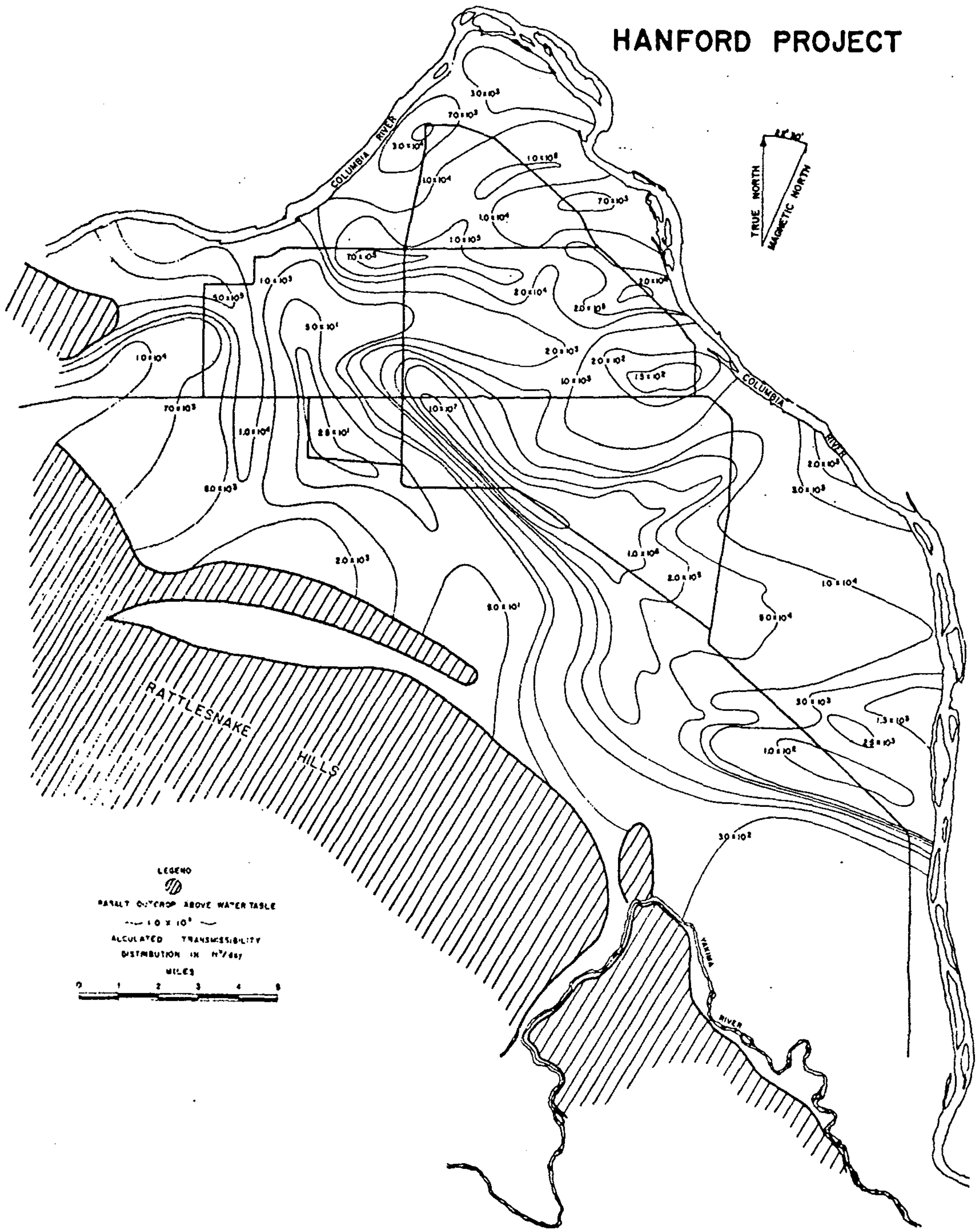
Supp. Filing 9/27/71



Groundwater Potential Rise vs. Time
Beneath 200 East Area

FIGURE 025-8

Supp. filing 9/27/71



Calculated Transmissivity Distribution of the Hanford Groundwater Flow System

FIGURE 025-9

Supp. Filing 9/27/71

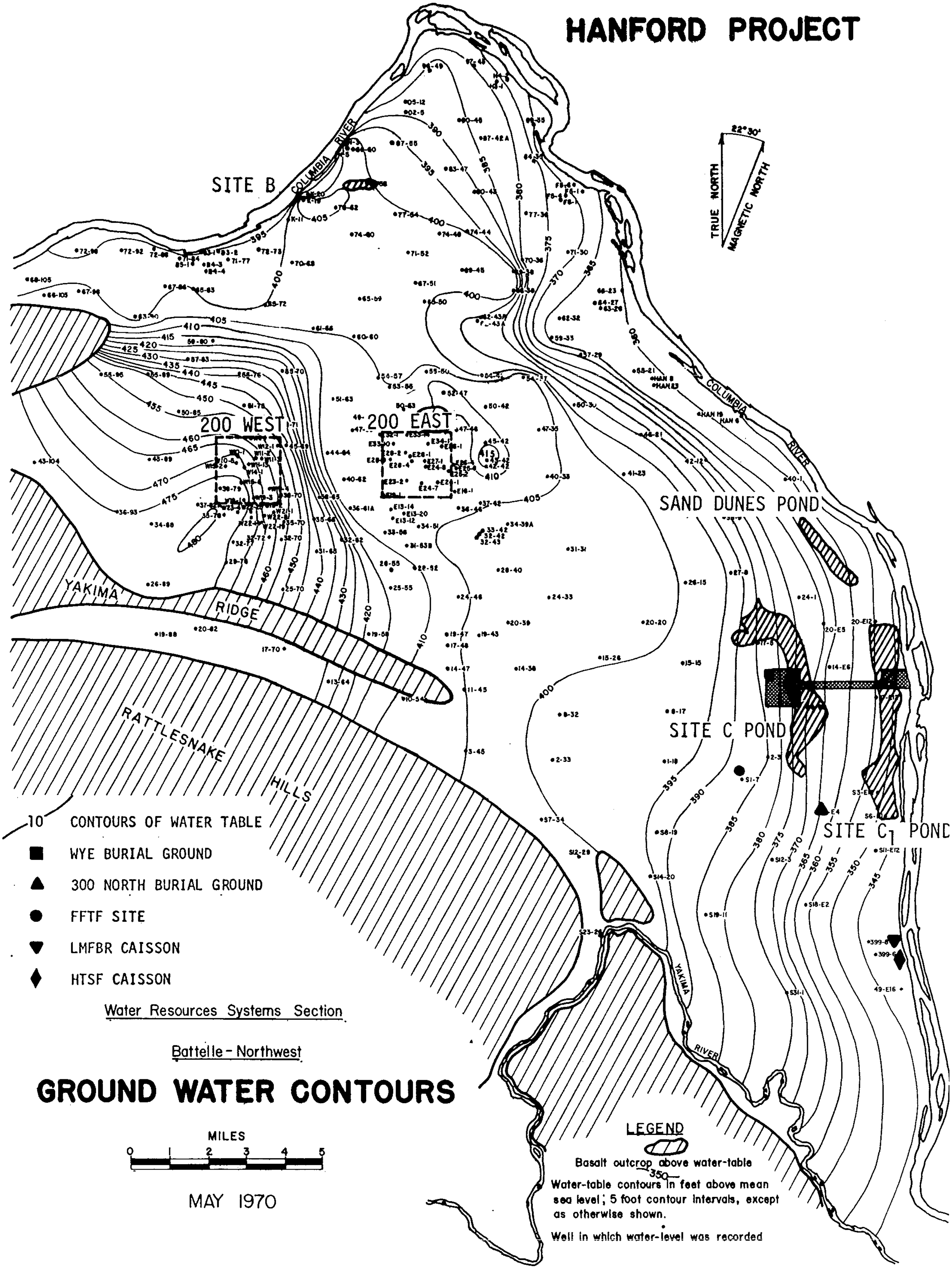


FIGURE 025-10

Supp. filing 9/27/71

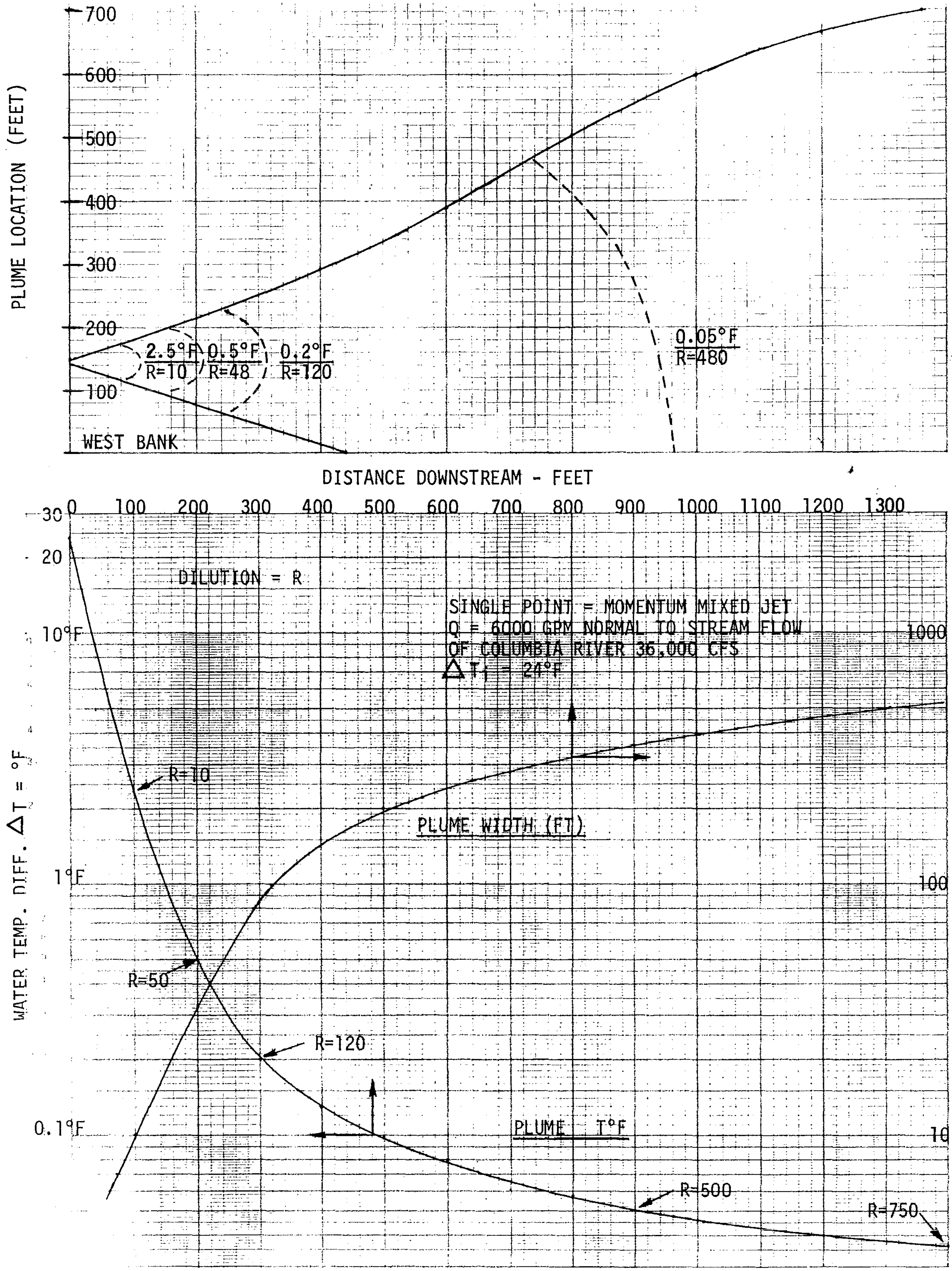
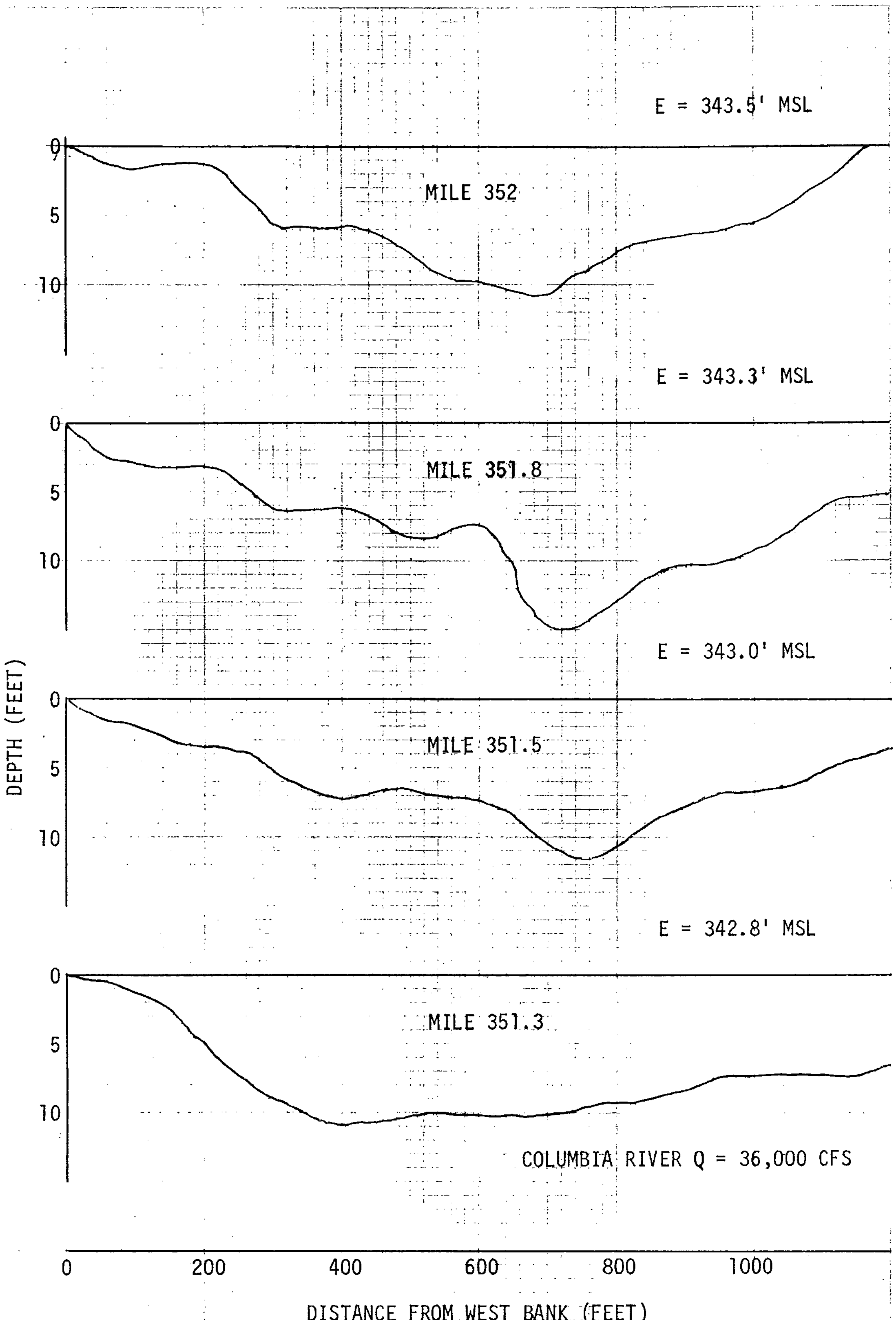


FIGURE 025-11

Supp. filing 11/12/71



CROSS SECTIONS OF THE COLUMBIA RIVER IN THE PLANT VICINITY

FIGURE 025-12

Supp. filing 11/12/71

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Section 030

Air

WAC 463-12-030 - *QUALITY OF THE ENVIRONMENT - AIR*

(1) Provide plans for the compliance with air pollution control standards.

The Project will be a nuclear plant and as such will not burn any fossil fuels under normal operating conditions except when testing the emergency diesel generators and emergency fire pumps. This equipment will be routinely tested on a weekly basis and routinely tested under load conditions approximately on a quarterly basis.

During plant shutdown, the house heating boiler will be used for space heating and to maintain temperature in certain plant equipment and facilities.

The Supply System will provide the Council with information and preliminary designs for the emergency diesel generators, emergency fire pumps, and house boiler not later than July 1, 1971.

Pursuant to 10 CFR Part 20, and other Federal regulations, the Supply System will monitor the facility ventilation systems and the site environs to assure and confirm compliance with all applicable standards for any environmental releases of radio-active material. The Supply System's program for pre- and post-operational environmental monitoring including air-borne particulate sampling, is described in Section 015(4).

WAC 463-12-030(1) - QUALITY OF THE ENVIRONMENT - AIR
(Supp. filing 7/1/71)

The seven emergency diesel engines planned for installation at the Project are for the following purposes:

a. 2 - 5,000 h.p. diesel emergency generators

b. 1 - 4,000 h.p. diesel emergency generator, high pressure core spray (HPCS)

c. 3 - 25 h.p. diesel compressor drives for backup pumps to the diesel starting air system

d. 1 - 300 h.p. diesel drive fire pump

All diesels will use No. 2 diesel oil fuel. Test frequency of the diesel generators, the HPCS diesel generator and the diesel driven fire pump will be a minimum of once a month for two hours of operation.

Two auxiliary boilers will be provided, using No. 2 fuel oil. Average annual fuel consumption is estimated to be 435,000 gallons per year. Flue gas is not considered necessary with No. 2 fuel oil. The amount of light oil fuel used by the auxiliary heating boilers is approximately 1/1000th of the amount of oil required if Hanford No. 2 were to be an oil-fired generating plant.

The emergency diesels and the auxiliary boilers will use No. 2 fuel oil. Typical composition for this light fuel oil is as follows:

Carbon	86.28%
Sulfur	.40%
Hydrogen	13.00%
Nitrogen	.06%
Oxygen	.25%
Ash	.01%

The two auxiliary boilers will operate with about 80% combustion efficiency. Combustion controls for these boilers will be monitored by an alarm system and will signal off-normal condition. Calculated emmissions from the boilers are compared to the 1971 Air Quality Standards proposed by the Environmental Protection Agency.

	EPA Proposed Air Quality Standards	Calculated Emmissions from Standby Auxiliary Boilers
NO, NO_2	0.3 lbs/10^6 BTU	Less than limit
SO_2	0.8 lbs/10^6 BTU	.402 lb/10^6 BTU
Ash	0.2 lbs/10^6 BTU	0.005 lbs/10^6 BTU

No similar comparison of emmissions with Washington State Air Quality Standards can be made at the present time because State standards have not yet been adopted as of November 1971.

Exhaust emmissions are not available from the seven emergency diesels under their brief testing mode of operation. Combustion efficiency under these conditions is expected to be lower than that for the auxiliary boilers but the total yearly oil usage for these machines operating at the planned testing frequency is less than 20,000 gallons per year.

(2) Demonstrate by acceptable research and study the extent to which fogging, misting, icing, obscuration of visibility or plumes would occur as a result of the operation of any proposed off-stream cooling facilities.

A cooling pond will be used for off-stream cooling of the Hanford No. 2 Project. The pond will accomplish the desired heat transfer from the coolant to the atmosphere by a combination of evaporation, convection and radiation processes of heat transfer. The portion of the heat transferred by each process will vary depending on the meteorological conditions of the area. Under certain conditions, the evaporative process will act to produce a visible cloud plume. Icing may occur in winter when the cloud contacts surfaces that are at or below $0^{\circ}C$. ($32^{\circ}F$.).

Frequency of Occurrence of Artificial Fog and Clouds

The combination of low temperature-high relative humidity atmospheric conditions under which visible clouds are most likely to form and persist due to cooling system operation occur during the winter months. One analysis places the frequency of local, natural fogs, which result in visibility being reduced in areas to one-fourth of a mile or less, at an expected rate of 24 days per year with 93% of these 24 days occurring during the months of November, December, January and February. It follows that Hanford No. 2 will generate visible clouds during this same period. A precise estimate of the percentage frequency of occurrence of artificial clouds cannot be made until the cooling system design is selected, design of the cooling pond has been determined and a detailed analysis has been made which relates expected atmospheric conditions with the design and operating characteristics of the cooling pond. Preliminary analyses will be submitted to the Council not later than September 1, 1971.

Persistence of Clouds (Fog)

Clouds and fog consist of condensed water droplets (or ice crystals). When the water droplets evaporate, fall to the ground (rain, snow) or disperse, the cloud or fog is no longer visible. A number of interrelated factors determine the speed with which droplet evaporation or dispersal take place over a cooling pond.

On days when the surrounding air is warmer than the temperature of the water droplets in air, heat will flow from the air to the water droplets causing them to vaporize - and disappear. At these times clouds will not form. In wintertime, the ambient air temperature will frequently be below the initial temperature of water vapor formed over the pond surface. This cooler ambient air and warmer vapor will mix to produce a cloud of water droplets analogous to the visible cloud created from breathing in cold weather. In these cases, further mixing with more cold air may result in cloud dispersion or, under adverse conditions, may result in a persistent cloud. An analogous situation may be observed with aircraft contrails.

Key factors which determine the formation and persistence of the plume from a cooling pond are as follows:

a. Operating temperature of the cooling pond.

b. Ambient air temperature.

c. Relative humidity of the air.

d. Wind velocity.

e. Atmospheric stability.

The operating temperature of a cooling pond will vary with changes in atmospheric conditions. Average pond temperatures will be greater in summer than in winter assuming the pond surface area remains about the same. The corollary to this is that the pond surface area required to dissipate a given heat load will be greater in summer than in winter.

On a given day, under fixed atmospheric conditions, an increase in pond temperature will tend to increase the relative pond evaporation rate and tend to increase cloud persistence.

Relative humidity (R.H.) of the ambient air is one measure of the air's capability to absorb moisture. Other conditions being fixed, an increase in R.H. will result in less evaporation from the cooling pond. However, any cloud that forms in this situation will be more likely to persist. This follows from the fact that an increase in R.H. decreases the capacity of air to absorb more water vapor thus slowing the rate of droplet evaporation.

The effect of wind speed on evaporation, cloud formation and cloud persistence is complex. In general, however, it may be stated that higher wind speeds will tend to dissipate any cloud that does form more rapidly.

Atmospheric stability refers to the vertical temperature profile of the atmosphere. The more stable the atmosphere, the less the decrease in temperature with altitude. Under stable conditions, a cloud formed over a cooling pond will not rise as rapidly as it will under unstable conditions and vertical mixing will not occur as quickly; therefore, cloud persistence will tend to be greater and the cloud will be confined to lower altitudes. (An inversion is an atmospheric condition in which the air temperature at higher altitudes is greater than the temperature at lower altitudes.)

Preliminary Estimate of Meteorological Effect - Hanford No. 2 Cooling System

Preliminary studies indicate that the Hanford No. 2 cooling pond could have a surface area of approximately 3,000 acres and dissipate a heat load of more than 2,000 megawatts. This heat load corresponds to more than 18 milliwatts per cm^2 which is of the same order of magnitude as the natural heat loads such as solar energy input to the atmosphere (per unit area on the earth's surface). In actual practice, the heat load will not be distributed uniformly over the surface of the pond. However, for these preliminary estimates, the heat load was assumed to be uniformly distributed.

During the winter when persistent plumes are more likely to be generated, the pond temperature may range from $5^{o}C$. to $20^{o}C$. above the ambient air temperature. This is a first approximation only and will be verified when design characteristics of the Project have been determined. Using a pond temperature of $10^{o}C$. above ambient air temperature, for illustrative purposes, and assuming ambient air at $0^{o}C$., preliminary calculations indicate that no cloud will form when the relative humidity is less than 75%. Under these same temperature conditions, a relative humidity of 80%, a wind speed of 1 meter per second, and an atmospheric stability condition that limits the plume rise to 100 meters, preliminary calculations indicate that a visible plume may extend approximately 4 kilometers downwind before dissipating. This is a first approximation based on purely diffusive mixing of the ambient air with cooling pond vapor. As such, it is conservative. In the actual operation of the pond, there will be an uneven heat load distribution over the pond's surface and plumes will probably form over limited areas when the relative humidity is less than 75%. These local plumes are expected to dissipate rapidly, however.

There are more severe but infrequent conditions conceivable under which cloud persistence would be greater than that indicated by the preliminary computations described above. One such case would be the passage of a cold front through the area in the wintertime. Due to the considerable heat capacity of a large cooling pond and its "flywheel effect", rapid changes in meteorological parameters may induce prolonged atmospheric effects.

The same is true for water bodies such as the Columbia River which is situated adjacent to the proposed cooling pond location. Fog from the river is a known winter phenomenon and fog persistence can occur large distances from the river. A preliminary calculation shows that the situation of the cold front advance mentioned above would result in a river fog plume extending many miles downwind. The particular conditions assumed in this case were the river operating at 5^{o}C. above ambient with ambient air at 0^{o}C. It was also assumed that a rapid change in ambient air temperature to -15^{o}C. might be the case following advance of a cold front. It was further assumed that stable air conditions and a 50% R.H. prevailed behind the frontal system. The computation was based purely on diffusive mixing and is therefore conservative.

Preliminary calculations for the cooling pond using these same ambient conditions and assuming an initial cooling pond temperature averaging 10^{o}C. above ambient yielded significantly greater cloud persistence. As pond cooling takes place due to the influence of the cold front, the persistence of the pond cloud would diminish and tend to approach that of the river itself. The cooling pond is expected to have little effect on the frequency of local fogs in the area but it may influence the extent and persistence of such fogs. A more rigorous analysis of cloud persistence effects will be carried out prior to September 1, 1971 and transmitted to the Council.

Local roads on the Hanford Reservation may be effected by occasional icing from cooling pond clouds in the winter. Any new service roads on the Reservation should take this into consideration in their design to reduce their icing vulnerability. This means elimination of steep grades and sharp curves where icing is possible. Any increased icing of public roads in the area due to the cooling pond plume is expected to be minimal. Icing of transmission lines is also a potential problem, and new lines should be located so as to minimize the possibility of icing and should be designed to withstand the additional weight of ice loading. The predominantly westerly trend of winter winds suggests that the power plant itself could be located west of the cooling pond to minimize the impact of icing on plant equipment and structures.

Supp. Filing 9/27/71 Summary of the Evaluation of Meteorological Effects by Battelle Northwest Laboratories. *

Introduction

The Atmospheric Sciences Department of Battelle, Pacific Northwest Laboratories at Richland, Washington, has conducted an evaluation of the probable fogging and icing which would result from cooling tower operations at the proposed site of the Washington Public Power Supply System's Hanford Number Two Nuclear Power Plant. The site, designated "C" site, is about 13 miles NNW of the center of the City of Richland and within the confines of the Hanford Project which is operated by various contractors for the Atomic Energy Commission.

The report first describes the basic principles of cooling tower operation and the concepts involved in the analysis. This is followed by a discussion of assumptions that were made and their effect on the results. The final section describes the results of the analysis for a mechanical draft and a natural draft cooling tower. The results are reported in terms of the number of hours of occurrence of a fog plume at the ground in various areas for above and below freezing conditions. Occurrences are also described for specific points of special interest. These occurrences are compared to the natural occurrences of fog and ice within the limits of available climatological data.

Discussion

Excerpts from the September 1971 Report by Battelle Northwest Laboratories are reproduced in the following discussion of the detailed results of the meteorological investigation.

1.0 Statement of Problem

Power generation requires the rapid dissipation of large quantities of waste heat. In the past, this heat has generally been dissipated to a natural stream or body of water. With increasing concern over the effect of heated discharges on aquatic life, alternate means of waste heat dissipation must be considered. In the case of Hanford Number Two, direct river cooling was considered unacceptable. Cooling ponds were eliminated from consideration due to potential adverse effects on the Wye Burial Ground resulting from raising the ground water table. This left evaporative type cooling towers as the remaining alternative means of heat dissipation within current technology for a power station of the size contemplated.

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* - Battelle Northwest Laboratories, "Final Report on a Meteorological Evaluation of the Effects of the Proposed Cooling Towers at the Hanford Number Two "C" Site on Surrounding Areas" to Burns & Roe, Incorporated, Hempstead, New York, September 1971.

Evaporative type cooling towers have the potential for creating visible plumes of water vapor under certain atmospheric conditions. These plumes may cause sufficient fogging or icing to significantly interfere with normal activities in the vicinity and their effects must be evaluated. In addition to being dependent on atmospheric conditions, plume characteristics also depend on the type of cooling tower used and its mode of operation. The type of tower selected is also related to the overall economics of the power generation which is outside of the scope of this report. This study evaluates the potential environmental effects of those cooling tower configurations which are technically feasible and which may be economically acceptable for the proposed Hanford Number Two Nuclear Power Plant.

1.1 Potential Environmental Effects

The plume is a region of air with a higher temperature and water content than the ambient air and represents a modification of the naturally occurring atmospheric conditions. Under those atmospheric conditions for which the plume remains invisible there is little real effect on normal activities. For the climatic conditions in the Hanford Area, excess water vapor in the plume will condense to form a visible plume approximately fifty-six and seventy-eight percent of the time for mechanical and natural draft cooling tower operation, respectively. Most of this occurrence is in the immediate vicinity of the plant. This plume will rise to high elevations and generally dissipate rapidly with no significant adverse effects. However, under certain atmospheric conditions and in certain areas it will persist at ground level with the potential to interfere with agricultural, commercial, industrial and private activities in the area covered by Figure 9. Potential environmental effects sufficiently important to be considered in this study are:

a. Fog and ice affecting highway and railroad transportation.

b. Fog affecting navigation on the Columbia River.

c. Ice building up on transmission lines.

d. Moisture from fog affecting grain harvesting activities.

e. Fog and ice affecting areas of Richland, North Richland, Kennewick, and Pasco.

f. Water vapor and fog affecting visibility at the observatory on Rattlesnake Mountain.

g. Fog restricting operation at the Pasco airport due to ceiling and ground level visibility limitations and ice interfering with ground operations.

Fog occurs naturally in the area, under both icing and nonicing conditions, and any cooling tower produced fog is an extension of the naturally occurring phenomenon, rather than being a new problem. Cooling tower produced fogs which are the most persistent and extend furthest from the station occur under the same conditions required for naturally occurring fogs. Section 1.2 presents specific results from the study of the extent and probability of occurrence of cooling tower fogging and icing and compares this incidence with that which occurs naturally.

1.2 Results of Study

1.2.1 Mechanical Draft Cooling Towers

1.2.1.1 Effects at Ground Level

The analysis conducted indicated that no fogging or icing would occur at ground level (under 700 ft. msl, See Figure 10) in the basin area of Hanford and the Tri-Cities. The basin area is that area at the same approximate elevation of the Hanford Number Two site.

The occurrence of the elevated fog plume in the Richland area could affect visual observations at the observatory on Rattlesnake Mountain by scattering light from the city.

At higher ground elevations, the probability of fog and ice increases because the main axis of the plume is approached. In addition to transmission lines, three highways and a railroad are located at altitudes and distances which will be intersected by the plume. Estimated annual occurrences for fog and ice are shown below:

Highway (#240) (18 mi northwest of site)	12 hours
Transmission Lines	70 hours
Pasco-Spokane Highway (#395) and Northern Pacific Railway (15 mi east of site)	19 hours
Richland-Benton City Highway (#410) (15 mi south of site)	26 hours
Hanford Project Highway (11 mi northwest of site)	21 hours

1.2.1.2 Agriculture Effects

Harvesting of grain crops continues through the night until the work is complete, unless dampness halts the work. During this harvesting period, which lasts from mid-July until the end of August, the relative humidity is lower and the temperature higher than at any other time of the year. Thus, the probability of transporting sufficient moisture far enough from the station to interfere with harvesting operations is extremely small.

1.2.1.3 Effects Above the Ground

At times the ambient conditions could result in a visible plume which does not contact the ground, but which would restrict air traffic at the Pasco airport by reducing the ceiling to less than 201 feet, which is the decision altitude. This problem has been investigated in considerable detail and the results indicate that such restriction would not occur.

1.2.2 Natural Draft Cooling Towers

The plume from a natural draft tower rises much higher than from a mechanical draft tower under all atmospheric conditions, because of the more concentrated heat source and the greater discharge height which could be 450-500 feet as compared to 60 feet for mechanical draft towers. This results in no occurence of fog or ice that would restrict operations at the Pasco airport or disrupt activity at ground level in the lower basin areas. Fogging and icing of roads at elevated locations would still occur, but at higher elevations and over smaller land areas. Estimated annual occurrences for fog and ice at affected locations are shown below:

Pasco-Umatilla Highway (#12) (27 mi south of site)	2 hours
Hanford-Yakima Highway (#24) (27 mi northwest of site)	1 hour

The analysis indicated that a visible plume would not contact the astronomical observatory on Rattlesnake Mountain; however, an analysis was not conducted for the uncondensed plume. An increase in atmospheric moisture content at the observatory could adversely affect operations to some degree.

1.2.3 Natural Occurrences of Fog and Ice

It is appropriate to place the preceding estimates of cooling tower produced occurrences in perspective by noting the natural occurrences of fog and ice. Natural occurrences at locations for which data are available are tabulated below:

Fog and Ice Occurrences

	Naturally Occurring	
	Fog	Ice
Pasco Airport	63 hrs (1)	72 hrs
Hanford Meteorology Station	101 hrs (2)	23 days
Hanford Meteorology Station	38 days (3)	
Richland	20 days (3)	20 days
N. Richland	20 days (3)	20 days

(1) Based on fogs with visibility 1/2 mile.

(2) Based on fogs with visibility 1/4 mile.

(3) Based on all fogs with visibility 0-6 miles.

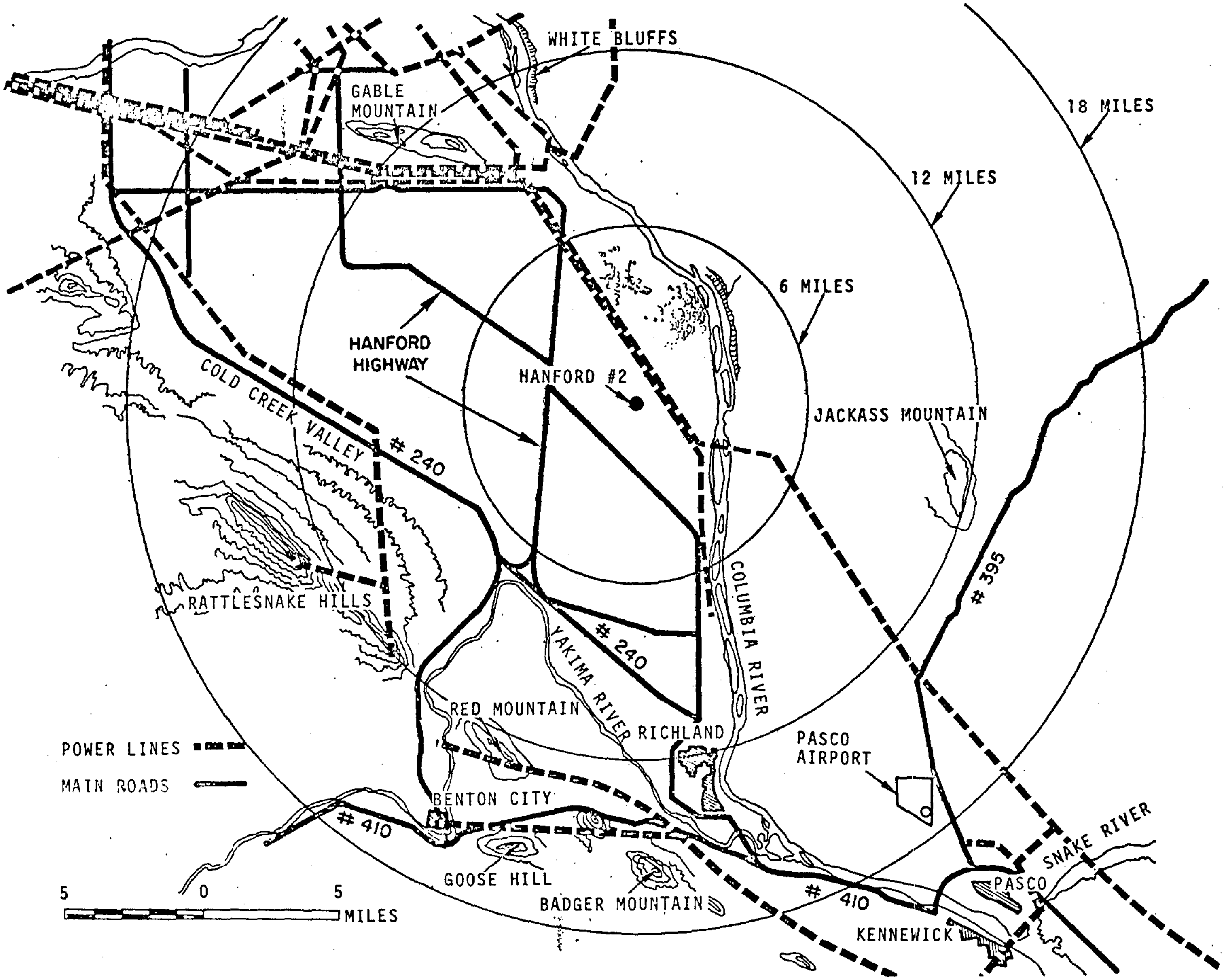
Some of the tower produced fog and ice will coincide with that which naturally occurs. However, even if it is conservatively assumed that this is not the case, it is apparent that the estimated incremental occurrences of fog given in Sections 1.2.1 and 1.3.2 due to the towers are small compared to the natural occurrences.

1.3 Conclusions

The study indicated that both the mechanical and natural draft cooling towers considered in this analysis would not produce ground level fog or ice in the basin area where the cities are located and that the cooling tower plumes would not restrict air traffic at the Pasco airport due to ceiling height limitations. At upper elevations both types of towers have effects on roads, railways, and transmission lines. Mechanical draft towers would cause effects at a lower elevation and hence over a more extensive area. Both natural draft and mechanical draft towers could occasionally affect visual observations at the astronomical observatory on Rattlesnake Mountain.

Mechanical and natural draft towers would both have a small effect on the environment and appear to be acceptable methods of dissipating waste heat from the Hanford Number Two Nuclear Power Station.

FIGURE 030-9



Area Map Showing Hiways and Major Transmission Lines

Supp. Filing 9/27/71

A summary of the potential environmental effects from both the hyperbolic natural draft cooling tower and the mechanical draft cooling tower system are reported in Section 030(2) Supp. Filing 9/27/71 with reference to details of the calculations in "Final Report on a Meteorological Evaluation of the Effects of the Proposed Cooling Towers at the Hanford Number Two 'C' Site on Surrounding Areas" Battelle-Northwest Laboratories, September 1971. It was concluded there that neither type of cooling tower would produce ground level fog or ice in the basin area where the cities are located and that the cooling tower plumes would not restrict air traffic at the Pasco airport. The same can be said of the Richland Airport. However, at higher elevations where the condensed cooling tower plume may intersect the terrain some fogging or icing could occur during the winter months. Of particular concern would be tower produced fogging or icing conditions that would cause increased danger or inconvenience to the public or produce some economic damage or otherwise interfere with their activities.

Fog occurs naturally in the area, under both icing and non-icing conditions, and cooling tower produced fog is an extension of the naturally occurring phenomenon. Some of the tower produced fog and ice will coincide with that which naturally occurs. However, even if it is conservatively assumed that they are separate events, it is apparent that the estimated incremental occurrences of fog due to cooling tower operation are small compared to the natural occurrences. For example, on Highway #410 approximately 15 miles south of the site, the annual occurrence of fog and ice from the cooling tower plume is estimated to be 26 hours over a portion of the ten mile stretch of road. The natural occurrence of these conditions in the Richland area is 20 days per year as observed from a single point which would constitute an estimated 250-300 hours of natural fog occurrence somewhere along this stretch of highway, much of which would be "patchy" ground fog. Since the primary activity affected by fog is travel along the highway, the incremental fog, should it occur, is essentially an extension of a road condition already existent in the area. Likewise, formation of rhime ice or hoar frost on structures and surfaces, except in the immediate vicinity of the plant would hardly be discernible from natural occurrences of these phenomena and would not interfere with normal activities and land use in the area, including farm crop production.

(3) Provide an engineering report and evaluation of proposed fossil-fueled and nuclear-fueled power plants to demonstrate that the highest and best practicable contaminant emission control technology will be used, including the utilization of fossil fuel with the lowest technically feasible sulfur content consistent with applicable standards.

Radioactive emissions to the atmosphere from nuclear plants are subject to regulation by the AEC as provided in Chapter 10 CFR Part 20 "Standards for Protection Against Radiation". Regulations currently require adherence to a least practicable emissions objective, subject to specific limits. The character of the emissions will vary, to a degree, depending upon plant design. In no event will plant design permit radioactive emission in excess of those allowable under 10 CFR 20 and applicable AEC standards for licensing. An engineering report and evaluation will be prepared, after the nuclear steam supply system is selected, describing the contaminant emission control facilities.

It is the policy of the Supply System to maintain radioactive exposure and releases well within applicable standards established by the U. S. Atomic Energy Commission.

Contaminant Emission Control Facilities

Gaseous wastes from Hanford No. 2 will consist of ventilation air discharged from buildings and off-gas from the air ejector which maintains vacuum on the steam condenser by removing non-condensable gases.

Ventilation air from all buildings which potentially could have radioactive contamination will be filtered before discharge. Process off-gas requires more extensive treatment in order to keep release of radioactivity as low as practicable.

The off-gas system, shown in Figure 030-8, will use a high temperature catalytic recombiner to recombine radiolytically dissociated hydrogen and oxygen from the air ejector system. After chilling to strip the condensables and reduce the volume, the remaining noncondensables (principally krypton, xenons and air) will be delayed in the 30-minutes hold-up system before reaching the adsorption bed. The charcoal adsorption bed, operating in a $0^{o}F$ constant-temperature vault, will selectively adsorb and delay the xenons and kryptons from the bulk carrier base (principally air). This delay on the charcoal permits the Xe and Kr to decay in place.

The decay time provided by the 30-minute hold-up pipe and the long delay charcoal adsorbers is established to provide for major radioactive decay of the activation gases and fission gases in the main condenser off-gas. The adsorbers provide a 120-day xenon and a 105-hour krypton hold-up. The daughter products which are solids are removed by filtration following the 30-minute hold-up and/or are retained on the charcoal. Final filtration of the charcoal adsorber effluent precludes escape of charcoal fines which would contain radioactive materials. Particulate activity release is thus virtually zero.

Most radio-iodine will be retained in reactor water and condensate. The small amount of iodine which escapes to the off-gas system will be effectively removed by adsorption on charcoal.

Radiation monitors at the recombiner outlet continuously monitor radioactivity release from the reactor and, therefore, continuously monitor the degree of fuel leakage and input to the charcoal adsorbers. This radiation monitor is used to provide an alarm on high radiation in the off-gas. A radiation monitor is also provided at the outlet of the charcoal adsorbers to continuously monitor the release rate from the adsorber beds. This radiation monitor is used to isolate the off-gas system on high radioactivity to prevent treated gas of unacceptably high activity from being vented to atmosphere.

Shielding is provided for off-gas system equipment to maintain safe radiation exposure levels for plant personnel. The equipment is principally operated from the control room.

The charcoal adsorbers operate at 0°F temperature so that upon plant shut-down, radioactive gases in the adsorbers will be subject to the same hold-up time as during normal operation, even in the presence of continued air flow. The charcoal adsorbers are designed to limit the temperature of the charcoal to well below the charcoal ignition temperature, thus precluding overheating or fire and consequent escape of radioactive materials. The adsorbers are located in a shielded room maintained at a constant temperature by an air conditioning system which removes the decay heat generated in the adsorbers. Failure of the refrigeration system will cause an alarm in the control room. In addition, a radiation monitor is provided to monitor the radiation level in the charcoal bed vault. High radiation will cause an alarm in the control room.

The hydrogen concentration of the gases from the air ejector is maintained below the flammable limit by maintaining adequate steam flow for dilution at all times. This steam flow rate is monitored and alarmed. The pre-heaters are heated with steam rather than electrically to eliminate presence of potential ignition sources and to limit the temperature of the gases in event of cessation of gas flow. The recombiner temperatures are monitored and alarmed to indicate any deterioration of performance. A hydrogen analyzer downstream of the recombiners performs an additional check.

The air ejector off-gas system operates at a pressure of about 5 psig or less so the differential pressure which could cause leakage is small. To preclude leakage of radioactive gases, the system is welded wherever possible and bellows seal valve stems or equivalent are used.

Operational control is maintained by the use of radiation monitors to keep the release rate within the established limits. Environmental monitoring is used to determine resultant dose rates and to relate these to the release rates as a check on station performance. Provision is also made for sampling and periodic analysis of the influent and effluent gases for purposes of determining their composition. This information is used in calibration of the monitors and in relating the release to environs dose. The operator is thus in full control of the system at all times.

(4) Provide preliminary data, either from available records or from reasonable estimates, as to air quality and meteorologic conditions at the proposed site. Meteorologic data should include (as a minimum) wind and direction patterns, rainfall and temperature regimes.

Meteorology

The principal source of meteorological data, at Hanford, is the 622-R Meteorology Tower (Figure 030-3), a 410 foot tower fitted with temperature, humidity, and wind velocity sensors. The tower is located on a plateau near the center of the Hanford Reservation, (Figure 030-4) adjacent to the 200 West processing plant area.

Standard surface observations are also available from the Hanford weather station located at the tower site. A network of remote ground stations that measure wind velocity at about 15 feet above the ground surface is available.

Climate

The Columbia River region, in which the Hanford Reservation lies, has the lowest elevation of any part of Central Washington. This assists in creating a relatively mild continental steppe climate, subject to a rather wide seasonal range in temperature. Annual precipitation, which is light, falls mainly during the winter months as rain. Winds are generally moderate, though calms and windstorms are not uncommon.

The following information is from summarized data taken at the 622-R Meteorology Tower. This station has been in continuous operation for more than 20 years. The average summer temperature is 73.7°F, but temperatures greater than 100°F can be expected 13 days each year. During the winter months, the mean daily temperature is 32.4°F. Temperatures below 0°F are expected four days each year. The minimum and maximum temperatures were -27°F in December, 1919 and 115°F in July, 1939. Precipitation averages 6.4 inches per year. The heaviest rainfall of record occurred in October, 1957, with 1.68 inches in six hours. The greatest snow depth was 12 inches in December, 1964. Northwest winds predominate at the station, but prevailing west winds have been observed at the 100-N meteorological tower during the two years of its operation. Gusts to 72 mph have been observed at the 50 foot level of the station 622-R tower.

Significant differences in the meteorology throughout the Hanford Reservation are attributed largely to terrain features. Terrain elevations range from near 3,800 feet at the crest of the Rattlesnake Hills on the southwest, to 400 feet along the Columbia River. The Supply System's Site is characterized by frequently light and variable winds.

Atmospheric Stability

Vertical mixing is an important factor related to the dilution of any contaminant released to the atmosphere. This parameter is related to atmospheric stability which is usually a function of the vertical temperature distribution or temperature stratification.

Vertical temperature difference at Hanford is measured at the meteorology station tower 622-R. The difference in temperature between the 200 foot and 3 foot level is a measure of atmospheric stability. A very stable (VS) condition is defined as a temperature difference ($T_{200} - T_3$) greater than or equal to 3.5°F. A moderately stable (MS) condition is defined by a difference less than 3.5°F, but greater than or equal to -0.5°F. An unstable (U) condition is defined by a difference equal to or less than -1.5°F. The intermediate range is considered as neutral (N). Table 030.4-1a presents the frequency of occurrence of these conditions during a season and for the year during the period January 1955 through July 1961.

TABLE 030.4-1a

PERCENTAGE FREQUENCY OF OCCURRENCE OF VERY STABLE MODERATELY STABLE, NEUTRAL AND UNSTABLE LAPSE RATES AT THE HANFORD METEOROLOGY TOWER[16]

(Based on Hourly observations for the period January, 1955 through July, 1961) $\Delta T = (T_{200} - T_3)$ °F

Lapse Rate Classification	Season: Winter	Spring	Summer	Fall	Annual
Very Stable (VS) ($\Delta T > 3.5$)	24	22	17	33	24
Moderately Stable (MS) ($3.5 > T \geq -0.5$)	43	32	29	31	34
Neutral (N) ($-0.5 > \Delta T \geq -1.5$)	24	10	9	13	14
Unstable (U) ($\Delta T \leq -1.5$)	9	36	45	23	28

Available observations on temperature stratification above 400 feet indicate that temperature inversions up to 10,000 feet msl are very rare during the colder seasons. The frequency of higher level inversions in various height intervals for the period November 1955 through March 1958 is shown in Table 030.4-1b.

TABLE 030.4-1b

PERCENT OF UPPER AIR OBSERVATIONS WHICH SHOWED A TEMPERATURE INVERSION WITHIN THE INDICATED HEIGHT INTERVAL (16)

Height Interval (Ft. above MSL)	Frequency of Temperature Inversion (Percent of Observations)
1000 - 3000	23
3000 - 5000	10
5000 -10000	12

Wind Direction Distribution

The configuration of topographic features of the Reservation are such that, under stable conditions, little airflow can enter except from the north and northwest, and that which enters must flow out mainly between the bluffs and the Rattlesnake Hills, with a minor amount of exchange between the Columbia River Valley and the Yakima River Valley. Those places where stable air can enter the Reservation are from the valleys between the Rattlesnake Hills and the Yakima Ridge, between the Yakima Ridge and Saddle Mountains, and through the gap in the Saddle Mountains where the Columbia River has cut through at Beverly.

The surface wind velocity distributions as measured at remote wind stations over the Hanford Reservation for the period 1952-56 are summarized by the Figure 030-5 Wind Roses. Tables 030.4-2a through 2e show the frequency distribution of wind speed and wind direction at the 200 foot level. The difference in flow patterns between the 200 Area plateau and the river are evident by comparison of wind roses for Station 8 (the Meteorology Tower in the 200 Area) and Stations 9 and 17 (300) Area).

The changes in the wind direction at 9 and 17 are caused by topographic influences along the river. The nocturnal drainage wind usually observed at Hanford is evident from the high frequency of downslope, or northwest winds along the major axis of the valley and general convergency of flow along the river. During the daytime hours, 0700 to 1900 PST, the wind is generally more variable because higher frequency of upslope movement is observed.

The 622-R Meteorology Tower is the location of a long climatic record period and is usually considered representative of the total Hanford Reservation exclusive of local terrain influence.

TABLE 030.4-2a

FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION AT 200-FOOT LEVEL
(Based on data for period 1951-1953)

PER CENT OF TIME

SPRING

Wind From	Hourly Average Wind Speed (MPH) 0-4	5-9	10-14	15-19	>20	Total %
NNE	1.14	1.14	0.95	0.31	0.19	3.73
NE	1.19	1.22	0.76	0.24	0.04	3.45
ENE	1.03	0.95	0.36	0.06	0.00	2.39
E	1.20	0.89	0.33	0.09	0.00	2.51
ESE	1.29	0.91	0.18	0.06	0.00	2.44
SE	1.01	0.88	0.22	0.04	0.03	2.19
SSE	0.68	0.94	0.46	0.33	0.12	2.53
S	0.91	0.91	0.37	0.25	0.21	2.65
SSW	0.65	1.09	0.76	0.58	0.45	3.52
SW	0.65	1.41	1.32	1.01	2.54	6.94
WSW	0.64	1.61	2.50	2.22	2.02	8.98
W	0.80	2.60	3.18	1.32	0.89	8.80
WNW	0.86	3.23	5.20	4.31	3.60	17.21
NW	1.49	4.28	4.89	3.72	4.51	18.89
NNW	1.61	2.30	1.64	0.86	0.73	7.14
N	1.49	2.05	1.12	0.30	0.02	4.97
Variable	1.04	0.28	0.00	0.00	0.00	1.32
Calm	----	----	----	----	----	0.31
Total	17.99	26.69	24.24	15.70	15.35	99.97

TABLE 030.4-2b

FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION AT 200-FOOT LEVEL
(Based on data for period 1951-1953)

PER CENT OF TIME

SUMMER

Wind From:	Hourly Average Wind Speed (MPH) 0-4	5-9	10-14	15-19	>20	Total %
NNE	0.59	1.13	0.88	0.14	0.11	2.84
NE	1.12	1.41	0.65	0.32	0.18	3.68
ENE	0.62	0.92	0.35	0.20	0.06	2.15
E	0.97	0.95	0.17	0.03	0.00	2.12
ESE	1.26	1.04	0.09	0.00	0.00	2.39
SE	0.67	1.12	0.18	0.00	0.00	1.97
SSE	0.59	0.82	0.56	0.18	0.02	2.16
S	0.83	1.98	0.36	0.04	0.00	3.22
SSW	0.60	1.41	0.64	0.11	0.08	2.83
SW	0.85	2.24	2.01	0.91	0.60	6.61
WSW	0.71	2.01	2.06	1.45	0.59	6.82
W	0.80	2.47	2.95	0.94	0.39	7.55
WNW	0.76	3.31	6.78	6.35	3.72	20.92
NW	1.03	3.87	4.90	3.92	7.46	21.18
NNW	0.86	2.83	1.13	0.35	0.08	5.25
N	1.48	2.36	0.83	0.14	0.02	4.82
Variable	1.98	1.04	0.02	0.00	0.00	3.04
Calm	----	----	----	----	----	0.45
Total	16.17	30.91	24.56	15.08	13.31	

TABLE 030.4-2c

FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION AT 200-FOOT LEVEL
(Based on data for period 1951-1953)

PER CENT OF TIME

FALL

Wind From:	Hourly Average Wind Speed (MPH) 0-4	5-9	10-14	15-19	≥20	Total %
NNE	1.89	1.17	0.76	0.14	0.03	3.99
NE	2.45	0.64	0.43	0.03	0.00	3.55
ENE	1.64	0.23	0.06	0.03	0.00	1.96
E	2.39	0.38	0.02	0.00	0.00	2.79
ESE	2.74	0.53	0.03	0.03	0.00	3.34
SE	2.62	1.14	0.47	0.14	0.06	4.43
SSE	1.14	1.23	0.56	0.24	0.08	3.26
S	1.36	0.87	0.37	0.08	0.17	2.83
SSW	1.05	0.79	0.56	0.55	0.73	3.69
SW	0.88	1.05	0.98	0.91	1.36	5.18
WSW	1.23	1.14	1.51	1.60	0.90	6.38
W	1.60	2.36	1.72	0.61	0.29	6.58
WNW	1.81	4.52	5.07	2.85	1.49	15.75
NW	2.45	5.80	6.18	3.18	1.69	19.30
NNW	3.15	3.06	0.90	0.09	0.02	7.22
N	3.00	2.56	0.44	0.11	0.09	6.20
Variable	1.08	0.12	0.00	0.00	0.00	1.20
Calm	----	----	----	----	----	2.35
Total	34.83	27.59	20.06	10.59	6.90	

TABLE 030.4-2d

FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION AT 200-FOOT LEVEL
(Based on data for period 1951-1953)

PER CENT OF TIME

WINTER

Wind From:	Hourly Average Wind Speed (MPH) 0-4	5-9	10-14	15-19	≥20	Total %
NNE	1.46	0.60	0.24	0.18	0.03	2.51
NE	1.58	0.41	0.00	0.03	0.17	2.19
ENE	1.41	0.34	0.06	0.00	0.00	1.81
E	2.05	0.43	0.11	0.00	0.00	2.59
ESE	2.83	0.43	0.21	0.02	0.00	3.49
SE	2.11	0.67	0.18	0.06	0.03	3.06
SSE	1.59	0.66	0.28	0.23	0.28	3.22
S	1.32	0.72	0.55	0.41	0.48	3.48
SSW	0.98	0.98	0.80	1.20	2.34	6.29
SW	1.00	1.29	1.75	1.68	3.81	9.52
WSW	0.90	1.81	1.39	1.24	1.46	6.80
W	1.67	2.01	1.65	0.66	0.23	6.22
WNW	1.91	4.27	4.75	1.75	0.64	13.32
NW	3.31	6.77	7.20	1.65	0.52	19.45
NNW	3.72	2.70	0.90	0.23	0.00	7.55
N	3.02	1.07	0.29	0.21	0.00	4.59
Variable	1.09	0.17	0.00	0.00	0.00	1.26
Calm	----	----	----	----	----	2.79
Total	34.74	25.33	20.36	9.55	9.99	

TABLE 030.4-2e

FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION AT 200-FOOT LEVEL

(Based on data for period 1951-1953)

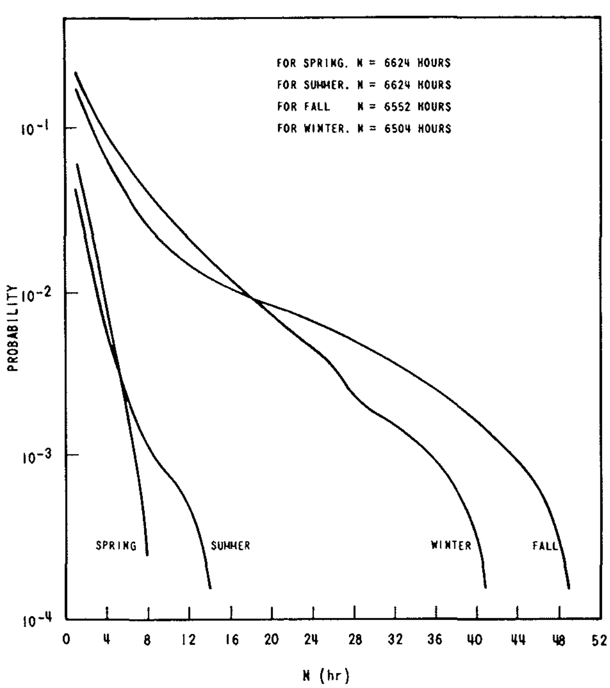
PER CENT OF TIME

ANNUAL

Wind From:	Hourly Average Wind Speed (MPH) 0-4	5-9	10-14	15-19	≥20	Total %
NNE	1.27	1.01	0.71	0.19	0.09	3.28
NE	1.58	0.92	0.46	0.16	0.10	3.22
ENE	1.17	0.61	0.21	0.07	0.02	2.08
E	1.65	0.67	0.16	0.03	0.00	2.50
ESE	2.02	0.73	0.13	0.03	0.00	2.91
SE	1.60	0.95	0.26	0.06	0.03	2.91
SSE	1.00	0.92	0.46	0.25	0.12	2.75
S	1.10	1.12	0.41	0.20	0.21	3.04
SSW	0.82	0.07	0.69	0.60	0.89	4.08
SW	0.84	1.50	1.51	1.13	2.08	7.06
WSW	0.87	1.74	1.87	1.63	1.24	7.26
W	1.21	2.36	2.38	0.88	0.45	7.30
WNW	1.33	3.83	5.45	3.82	2.38	16.81
NW	2.06	5.17	5.78	3.12	3.56	19.70
NNW	2.33	2.72	1.15	0.39	0.21	6.79
N	2.24	2.01	0.67	0.19	0.03	5.15
Variable	1.30	0.40	0.00	0.00	0.00	1.71
Calm	----	----	----	----	----	1.46
Total	25.85	26.63	22.30	12.75	11.41	

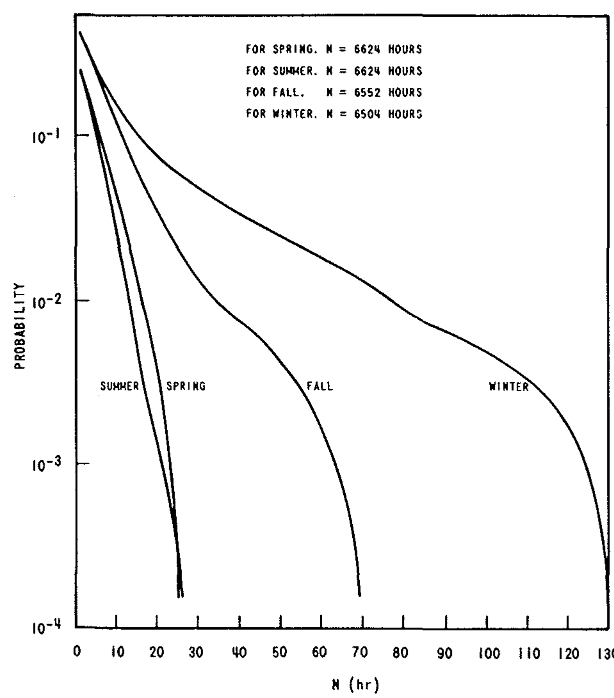
The prevailing wind directions are WNW and NW as measured at the meteorological tower 622-R. As seen in Table 030.4-2e, the annual percentage of winds of this class is well above the percentage of any other with NW prevailing over WNW. The event most likely to happen for winter and fall are NW and WNW winds with speeds in the 5 to 16 mph range, for summer between 5 and 19, and spring shows a larger frequency for winds of 10 to 16 mph, while the rest are almost equally probable.

The probability of light winds persisting for at least N hours at the 622-R Meteorology Tower is shown in Figures 030-1a and 030-1b.



Probability of Wind Blowing in the Same Direction for N Hours (wind speed ≤ 2 mph)

Figure 030-1a



Probability of Wind Blowing in the Same Direction for N Hours (wind speed ≤ 5 mph)

Figure 030-1b

The frequency of wind direction at the 5000 foot level over Hanford is shown in Table 030.4-3, where wind direction refers to the direction from which the wind blows.

TABLE 030.4-3

PERCENTAGE FREQUENCY OF WIND DIRECTION AT 5000FT. LEVEL OVER HANFORD

	Season				
Wind Direction Class Interval	Spring	Summer	Fall	Winter	Year
345°- 15°	5	5	7	5	6
15 - 45	5	7	9	4	6
45 - 75	6	5	6	4	5
75 - 105	4	4	5	3	4
105 - 135	3	3	3	2	3
135 - 165	4	3	2	3	3
165 - 195	5	7	5	5	6
195 - 225	10	13	11	11	11
225 - 255	21	21	19	24	21
255 - 285	22	20	20	23	21
285 - 315	10	8	8	12	10
315 - 345	5	4	5	4	4

These data indicate only the initial direction of motion of a high altitude airborne cloud leaving Hanford. However, the trajectory analyses show a coniderable persistence in direction, and as indicated in Table 030.4-3. The northeast quadrant is the most likely direction of travel.

Deviations from normal climatology usually occur in regimes lasting several weeks and are fairly predictable. There are two such situations that would result in some deviations from the normal. The first is characterized by a large-scale easterly flow pattern brought about by a well-developed high-pressure system east of Hanford. In this case the most probable direction of travel is to the west and northwest, whereas the probability of easterly trajectories is very low. The other, a winter regime characterized by little air movement, often persists for weeks in the Columbia Basin. This condition would persist until a regime with westerly winds returned to the surface, providing a mechanism for transport of the large air mass to the east.

Precipitation

Precipitation scavenging is not considered a probable mechanism for depleting a contaminant cloud close to Hanford, primarily because the average annual precipitation is very light, i.e., 6.4 inches. Precipitation occurs on an average of 136 days each year, but only during 76 days is the total sufficient to measure. Precipitation occurs during only 6% of the hourly observations; and even during the three months of greatest monthly average rainfall, precipitation occurs during hourly observations only 11% of the time.

Severe Weather

The Pacific Northwest is one of the geographic areas of the country with the lowest frequency of tornadoes. Table 030.4-4 shows the tornadoes reported within 100 miles of Hanford since June, 1916. The only one of these that reached the ground and did any damage occurred west of Yakima on May 29, 1948. This one destroyed an uninhabited mountain camp.

TABLE 030.4-4

TORNADOS REPORTED WITHIN 100 MILES OF HANFORD

Date	Nearest Town or Meteorological Observer
June 26, 1916	Walla Walla
September 2, 1936	Walla Walla
May 20, 1948	Yakima
May 29, 1948	Yakima
June 11, 1948	Ephrata & Yakima
June 16, 1948	Hanford
May 10, 1956	Tri-City
April 14, 1957	Hepner
April 30, 1957	Yakima
April 24, 1958	Walla Walla
June 26, 1958	Wallula
March 24, 1961	Hanford

The U. S. Weather Bureau has recently reported the frequency, by state, of tornadoes occurring in the United States over a period of 46 years (1916-1961). The reported average annual frequency of observed tornadoes indicates a very low frequency of tornadoes in the State of Washington of less than one per year, as shown by Figure 030-2.

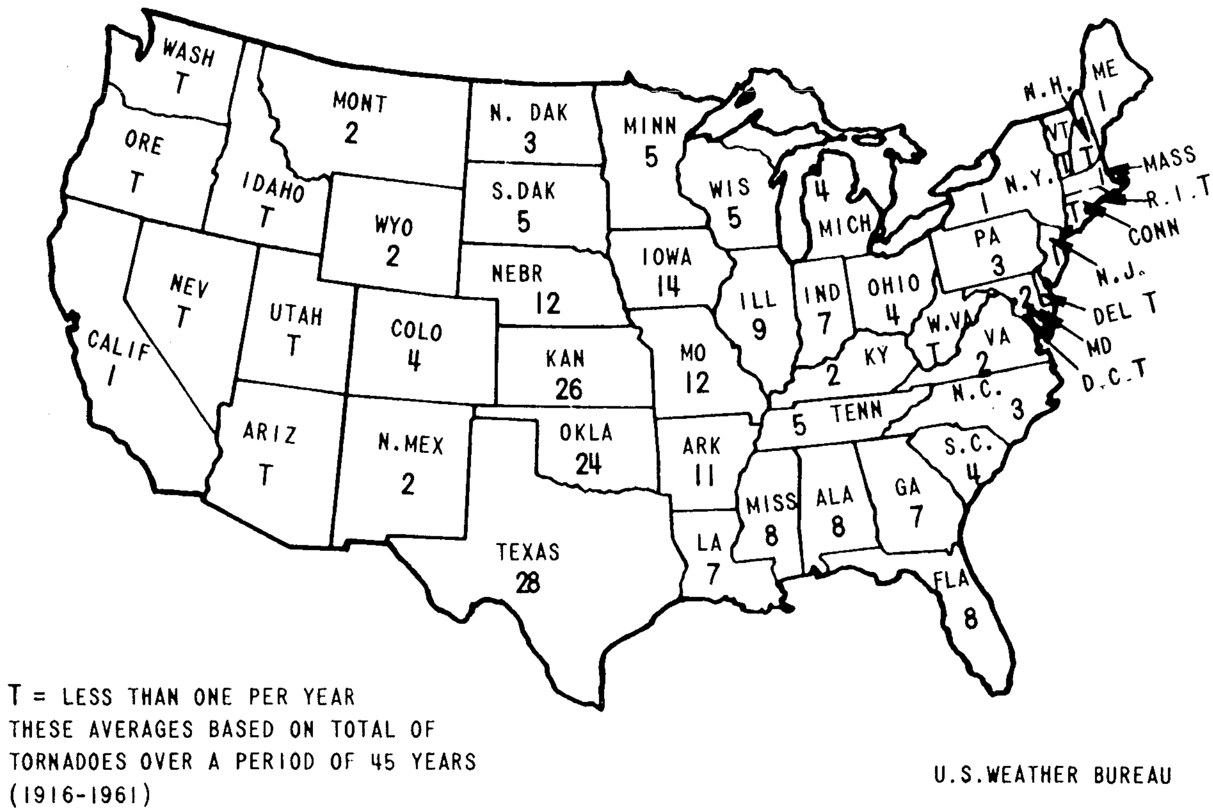


Figure 030-2 Average Annual Tornado Frequency

Table 030.4-5 summarizes meteorologic data at Hanford including maximum, minimum and average temperature, precipitation, wind, humidity, fog, solar radiation, as well as frequency of occurrences.

TABLE 030.4-5

AVERAGES AND EXTREMES OF CLIMATIC ELEMENTS AT HANFORD

(Based on all available records to and including the Year 1963)

TEMPERATURE (F) — 1912-63 AVERAGES / 1912-63 EXTREMES

	1912-63 AVERAGES							1912-63 EXTREMES: DAILY MAXIMUM				DAILY MINIMUM			
	DAILY MAXIMUM	DAILY MINIMUM	MONTHLY	HIGHEST MONTHLY	YEAR	LOWEST MONTHLY	YEAR	RECORD HIGHEST	YEAR	RECORD LOWEST	YEAR	RECORD HIGHEST	YEAR	RECORD LOWEST	YEAR
Jan.	36.4	21.7	29.0	42.5	1953	12.1	1950	65	1935	-2	1950	51	1921	-23	1937+
Feb.	44.6	26.9	35.8	44.5	1958	21.4	1929	71	1924	-3	1950	55	1932	-23	1950
Mar.	56.2	34.2	45.2	49.8	1926	39.4	1955	83	1960	24	1960	54	1942	6	1955
Apr.	66.6	40.4	53.5	59.6	1934	47.5	1955	95	1934+	41	1945	60	1956	12	1935
May	75.5	48.4	61.9	68.8	1947	56.6	1933	103	1936+	49	1919	70	1956	28	1954
June	83.0	55.3	69.2	75.4	1922	63.0	1953	110	1912	56	1950+	81	1924	33	1933
July	91.8	61.1	76.4	81.8	1960	72.4	1963	115	1939	66	1955+	82	1925	41	1935
Aug.	89.0	59.2	74.1	79.4	1958	70.5	1912	113	1961	63	1920+	80	1949	40	1918
Sept.	79.5	50.8	65.1	71.1	1963	58.8	1926	102	1950	52	1934+	72	1955	25	1926
Oct.	65.1	41.0	53.1	59.0	1952	48.8	1930	90	1933	31	1935	60	1945+	6	1935
Nov.	48.5	31.1	39.8	46.0	1954+	31.3	1955	73	1934	14	1955	52	1959+	-1	1955
Dec.	39.1	26.2	32.7	42.0	1933	18.5	1919	68	1933	-3	1919	53	1933+	-27	1919
Year	64.6	41.4	53.0	81.8	July 1960	12.1	Jan. 1950	115	July 1939	-3	Feb. 1950+	82	July 1925	-27	Dec. 1919

DEGREE DAYS (BASE 65) — 1945-63 TOTALS; PRECIPITATION (INCHES) — 1912-63 TOTALS

	DEGREE DAYS					PRECIPITATION							SNOW, SLEET						
	MEAN	MAXIMUM MONTHLY	YEAR	MINIMUM MONTHLY	YEAR	MEAN	MAXIMUM MONTHLY	YEAR	MINIMUM MONTHLY	YEAR	MAX. IN 24 HRS.	YEAR	MEAN	MAXIMUM MONTHLY	YEAR	MAX. IN 24 HRS.	YEAR	MAXIMUM DEPTH	YEAR
Jan.	1127	1640	1950	694	1953	0.92	2.16	1953	0.13	1962+	1.08	1948	5.3	23.4	1950	7.1	1954	11.5	1950
Feb.	799	1147	1956	576	1958	0.66	3.08	1940	T	1920	1.24	1916	2.7	26.0	1916	5.2	1959	8.8	1950
Mar.	653	794	1955	476	1947	0.39	1.86	1957	0	1942+	0.59	1949	0.3	4.2	1951	2.2	1957+	2.3	1957
Apr.	371	522	1955	266	1947	0.40	1.17	1963	0	1933+	0.53	1951	T	T	1955+	T	1955+	0	----
May	155	253	1955	36	1947	0.48	1.71	1948	0	1931	0.55	1948+	T	T	1960	T	1960	0	----
June	37	90	1953	3	1958	0.58	2.92	1950	0	1919	1.50	1934	0	0	----	0	----	0	----
July	3	22	1955	0	1961+	0.14	0.73	1914	0	1939+	1.25	1942	0	0	----	0	----	0	----
Aug.	4	32	1960	0	1961+	0.20	1.18	1920	0	1955+	0.73	1914	0	0	----	0	----	0	----
Sept.	68	118	1959	25	1963	0.32	1.34	1947	T	1961+	0.82	1947	0	0	----	0	----	0	----
Oct.	373	479	1946	200	1952	0.62	2.72	1957	0	1917+	1.91	1957	T	0.3	1957	0.3	1957	0.3	1957
Nov.	758	1008	1955	567	1954	0.83	3.05	1926	T	1939+	0.65	1949	1.4	12.7	1955	4.8	1955	5.1	1946
Dec.	982	1184	1948	822	1957	0.84	2.53	1931	0.11	1946	0.99	1958	3.3	13.4	1955	3.4	1955	5.3	1955
Year	5330	1640	Jan. 1950	0	Aug. 1961+	6.38	3.08	Feb. 1940	0	Aug. 1955+	1.91	Oct. 1957	13.0	26.0	Feb. 1916	7.1	Jan. 1954	11.5	Jan. 1950

WIND (mph); RELATIVE HUMIDITY (%)

	WIND 1945-63 AVERAGES						PEAK GUST			RELATIVE HUMIDITY 1946-63 AVERAGES					EXTREMES			
	PREVAILING DIRECTION	MEAN SPEED	HIGHEST	YEAR	LOWEST	YEAR	SPEED	DIRECTION	YEAR	MEAN	HIGHEST	YEAR	LOWEST	YEAR	HIGHEST	YEAR	LOWEST	YEAR
Jan.	NW	6.0	9.6	1953	3.1	1955	64	SW	1953	76	89	1960	60	1963	100	1963+	29	1956
Feb.	NW	6.8	9.4	1961	4.6	1963	59	SSW	1957	71	87	1963	63	1960+	100	1963+	20	1950
Mar.	WNW	8.2	10.2	1955	5.9	1958	70	SW	1956	58	66	1961+	49	1955	100	1963+	12	1955
Apr.	WNW	8.8	11.1	1959	7.4	1958	54	S	1958	48	64	1963	37	1951	100	1963+	9	1954
May	WNW	8.6	10.5	1951	5.8	1957	71	SSW	1948	44	63	1948	33	1947	99	1956	7	1953
June	WNW	9.1	10.7	1949	7.7	1950+	72	SW	1957	40	54	1950	30	1949	100	1956+	10	1955
July	WNW	8.6	9.6	1963	6.8	1955	50	WSW	1947	32	40	1955	22	1959	95	1955	6	1951
Aug.	WNW	7.9	9.1	1946	6.0	1956	66	SW	1961	35	42	1962	28	1955	100	1959+	7	1951
Sept.	WNW	7.4	9.2	1961	5.4	1957	65	SSW	1953	41	55	1959	34	1952+	100	1959+	10	1955+
Oct.	WNW	6.6	9.1	1946	4.4	1952	63	SSW	1950	59	74	1962	42	1952	100	1962+	10	1952
Nov.	NW	6.2	7.9	1945	2.9	1956	64	SSW	1949	73	80	1956	64	1959+	100	1963+	27	1952+
Dec.	NW	5.8	7.2	1957	3.9	1960	71	SW	1955	81	90	1963+	70	1949	100	1963+	28	1957
Year	WNW	7.5	11.1	Apr. 1959	2.9	Nov. 1956	72	SW	June 1957	55	90	Dec. 1963+	22	July 1959	100	Dec. 1963+	6	July 1951

SUNRISE TO SUNSET SKY COVER (SCALE 0-10); DAILY TOTALS OF SOLAR RADIATION (Langleys) *

	SKY COVER 1946-63 AVERAGES					SOLAR RADIATION 1953-63 AVERAGES					EXTREMES			
	MONTHLY	HIGHEST	YEAR	LOWEST	YEAR	MEAN	HIGHEST	YEAR	LOWEST	YEAR	HIGHEST	YEAR	LOWEST	YEAR
Jan.	7.6	8.9	1955+	4.3	1949	119	135	1962	88	1955	256	1956	22	1963
Feb.	7.5	8.9	1961	6.3	1947	194	238	1960	164	1954	422	1958	37	1962
Mar.	6.8	7.9	1950	5.7	1955+	336	363	1959	305	1961	535	1962	71	1963
Apr.	6.3	8.1	1963	3.7	1951	474	526	1959+	374	1963	691	1958	154	1963
May	5.8	7.7	1960	4.5	1949	559	619	1958	511	1962	782	1959	67	1962
June	5.1	7.0	1950	2.8	1961	633	698	1960	563	1953	809	1957	190	1961
July	2.5	4.5	1955	0.9	1953	666	700	1960	588	1955	780	1957	150	1955
Aug.	3.2	4.3	1954+	0.6	1955	558	613	1955	516	1954	721	1957	107	1959
Sept.	4.0	6.1	1959	2.5	1950	423	457	1961	354	1959	590	1959	61	1957
Oct.	5.8	7.7	1950	3.9	1952	258	299	1958	227	1956	428	1958	38	1962
Nov.	7.3	8.0	1962+	6.2	1957	141	180	1957	111	1956	283	1957	22	1956
Dec.	8.1	9.2	1962	6.8	1954	89	106	1960	73	1962	185	1961	14	1962
Year	5.8	9.2	Dec. 1962	0.6	Aug. 1955	371	700	July 1960	73	Dec. 1962	809	June 1957	14	Dec. 1962

NUMBER OF DAYS

	CLEAR					PTLY CLDY	CLOUDY					THUNDERSTORMS				
	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR
Jan.	4	13	1949	0	1955+	8	19	27	1952	6	1949	0	0	----	0	----
Feb.	5	9	1960	1	1961	6	17	26	1958	10	1951+	#	1	1962	0	1963+
Mar.	7	12	1955	2	1961+	9	15	21	1958+	7	1948	#	1	1962+	0	1963+
Apr.	7	18	1951	1	1963	11	12	21	1963	3	1949	1	3	1948	0	1962+
May	8	14	1953	2	1960	12	11	19	1960	3	1949	2	7	1956	0	1955+
June	11	21	1961	5	1957+	10	9	15	1957	0	1949	3	8	1948	0	1963+
July	21	27	1953	14	1955	7	3	8	1955	0	1953+	2	5	1958+	0	1962+
Aug.	19	30	1955	13	1962+	8	4	8	1961+	0	1955+	2	8	1953	0	1959+
Sept.	15	20	1952	9	1959	9	6	12	1959+	2	1952+	1	4	1959	0	1962+
Oct.	10	16	1953	3	1950+	9	12	18	1956+	3	1946	#	1	1960+	0	1963+
Nov.	5	10	1957	2	1962+	7	18	22	1956	12	1948	0	0	----	0	----
Dec.	3	7	1954	0	1947	7	21	28	1962	14	1946	0	0	----	0	----
Year	115	30	Aug. 1955	0	Jan. 1955+	103	147	28	Dec. 1962	0	Aug. 1955+	11	8	Aug. 1953+	0	----

	HEAVY FOG (VIS. 1/4 MI. OR LESS)					PRECIP. 0.10 INCH OR MORE					SNOW 1.0 INCH OR MORE				
	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR
Jan.	6	12	1955	0	1949	3	7	1959+	0	1962+	2	10	1950	0	1962+
Feb.	3	11	1963	0	1955+	2	5	1961+	0	1955	1	4	1959+	0	1963+
Mar.	1	5	1951	0	1963+	2	8	1957	0	1962+	#	2	1957+	0	1963+
Apr.	#	1	1950	0	1963+	2	5	1948	0	1956+	0	0	----	0	----
May	#	1	1958	0	1963+	2	4	1962+	0	1947	0	0	----	0	----
June	0	0	----	0	----	2	8	1950	0	1962+	0	0	----	0	----
July	0	0	----	0	----	1	3	1955	0	1962+	0	0	----	0	----
Aug.	#	1	1959	0	1963+	1	3	1953	0	1963+	0	0	----	0	----
Sept.	#	1	1957	0	1963+	1	5	1959	0	1963+	0	0	----	0	----
Oct.	1	6	1962	0	1963+	2	8	1950	0	1963+	0	0	----	0	----
Nov.	5	11	1952	0	1960	3	7	1955	1	1956+	1	6	1955	0	1963+
Dec.	8	17	1950	2	1949	3	6	1955	0	1949+	1	5	1955	0	1962+
Year	24	17	Dec. 1950	0	Oct. 1963+	24	8	Mar. 1957+	0	----	5	10	Jan. 1950	0	----

NUMBER OF DAYS

	3" OR MORE SNOW ON GND.					PEAK GUST 40 MPH OR GREATER					MAX. TEMP. 90 OR ABOVE				
	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR
Jan.	5	22	1950	0	1963+	3	9	1953	0	1957+	0	0	----	0	----
Feb.	3	16	1950	0	1962+	3	6	1961+	0	1962+	0	0	----	0	----
Mar.	0	0	----	0	----	3	9	1956	1	1958+	0	0	----	0	----
Apr.	0	0	----	0	----	3	6	1959	0	1963	#	4	1926	0	1963+
May	0	0	----	0	----	2	6	1951	0	1963+	3	11	1924	0	1962+
June	0	0	----	0	----	2	4	1961	0	1963+	9	20	1940+	0	1953+
July	0	0	----	0	----	1	4	1962+	0	1958+	21	29	1941	8	1963
Aug.	0	0	----	0	----	1	5	1951	0	1963+	18	29	1915	7	1948
Sept.	0	0	----	0	----	2	4	1951	0	1960+	5	16	1938	0	1946+
Oct.	0	0	----	0	----	2	5	1960	0	1957+	#	1	1933	0	1963+
Nov.	1	10	1955	0	1963+	3	5	1961+	0	1957+	0	0	----	0	----
Dec.	1	14	1955	0	1962+	3	8	1957+	0	1963+	0	0	----	0	----
Year	10	22	Jan. 1950	0	----	28	9	Mar. 1956+	0	Dec. 1963+	56	29	July 1941+	0	----

	MAX. TEMP. 100 OR ABOVE					MAX. TEMP. 32 OR BELOW					MIN. TEMP. 32 OR BELOW					MIN. TEMP. 0 OR BELOW				
	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR	MEAN	GREATEST	YEAR	LEAST	YEAR
Jan.	0	0	----	0	----	11	29	1937	0	1946+	27	31	1957+	9	1953	2	14	1950	0	1961+
Feb.	0	0	----		----	3	19	1936	0	1961+	21	28	1944+	5	1958	1	9	1929	0	1963+
Mar.	0	0	----	0	----	#	2	1960	0	1963+	16	25	1944+	6	1947	0	0	----	0	----
Apr.	0	0	----	0	----	0	0	----	0	----	5	15	1935	0	1962+	0	0	----	0	----
May	#	1	1958+	0	1963+	0	0	----	0	----	#	3	1938+	0	1963+	0	0	----	0	----
June	2	7	1961	0	1962+	0	0	----	0	----	0	0	----	0	----	0	0	----	0	----
July	7	16	1960+	0	1963+	0	0	----	0	----	0	0	----	0	----	0	0	----	0	----
Aug.	4	16	1942	0	1957+	0	0	----	0	----	0	0	----	0	----	0	0	----	0	----
Sept.	#	2	1955+	0	1963+	0	0	----	0	----	#	4	1926	0	1963+	0	0	----	0	----
Oct.	0	0	----	0	----	#	2	1935	0	1963+	5	12	1916	0	1962+	0	0	----	0	----
Nov.	0	0	----	0	----	1	15	1955	0	1962+	17	30	1936	4	1949	#	1	1955+	0	1963+
Dec.	0	0	----	0	----	8	19	1914	0	1939+	25	31	1963+	14	1933	1	14	1919	0	1963+
Year	13	16	July 1960+	0	----	23	29	Jan. 1937	0	----	116	31	Dec. 1963+	0	----	4	14	Jan. 1950+	0	----

EXTREME AVERAGES OR TOTALS AND YEAR OR SEASON OF OCCURRENCE

1912-63 TEMPERATURE AVERAGES (°F)

Highest Annual	56.2	1934
Lowest Annual	50.2	1929
Highest Winter (D-J-F)	41.1	1933-34
Lowest Winter	24.2	1948-49
Highest Spring (M-A-M)	58.2	1947
Lowest Spring	48.0	1955
Highest Summer (J-J-A)	78.2	1958
Lowest Summer	70.3	1954
Highest Autumn (S-O-N)	56.6	1963
Lowest Autumn	49.7	1936

1912-63 PRECIPITATION TOTALS (IN)

Greatest Annual	11.45	1950
Least Annual	3.38	1930
Snow, Sleet: Greatest Seasonal	43.6	1915-16
Snow, Sleet: Least Seasonal	0.3	1957-58

1945-63 WIND SPEED AVERAGES (MPH)

Highest Annual	8.0	1946
Lowest Annual	6.3	1957

1946-63 RELATIVE HUMIDITY AVERAGES (%)

Highest Annual	58	1950+
Lowest Annual	51	1949

1946-63 SKY COVER AVERAGES (SCALE 0-10)

Highest Annual	6.2	1950
Lowest Annual	5.1	1949

NUMBER OF DAYS

CLEAR:		
Greatest Annual (1946-63)	141	1951
Least Annual (1946-63)	92	1950
CLOUDY:		
Greatest Annual (1946-63)	181	1958
Least Annual (1946-63)	84	1949
THUNDERSTORMS:		
Greatest Annual (1945-63)	23	
Least Annual (1945-63)	3	
HEAVY FOG:		
Greatest Seasonal (1945-63)	42	1950-51
Least Seasonal (1945-63)	9	1948-49
PRECIP. 0.10 IN. OR MORE:		
Greatest ~~Seasonal~~ annual (1946-63)	39	1950
Least Annual (1946-63)	12	1949
SNOW 1.0 IN. OR MORE:		
Greatest Seasonal (1946-63)	15	1955-56
Least Seasonal (1946-63)	0	1957-58
3 IN. OR MORE SNOW ON GND.:		
Greatest Seasonal (1946-63)	39	1949-50
Least Seasonal (1946-63)	0	1957-58+
PEAK GUST 40 MPH OR GREATER:		
Greatest Annual (1945-63)	41	1961
Least Annual (1945-63)	13	1958
MAX. TEMP. 90 OR ABOVE:		
Greatest Annual (1912-63)	85	1940+
Least Annual (1912-63)	37	1954
MAX. TEMP. 100 OR ABOVE:		
Greatest Annual (1912-63)	32	1942
Least Annual (1912-63)	1	1954
MAX. TEMP. 32 OR BELOW:		
Greatest Seasonal (1913-63)	53	1955-56
Least Seasonal (1913-63)	1	1937-38
MIN. TEMP. 32 OR BELOW:		
Greatest Seasonal (1913-63)	141	1916-17
Least Seasonal (1913-63)	75	1957-58
MIN. TEMP. 0 OR BELOW:		
Greatest Seasonal (1913-63)	18	1949-50
Least Seasonal (1913-63)	0	1960-61+

REFERENCE NOTES

PRESENT LOCATION:

30 Miles NW of Richland, Washington

Latitude 46° 34' N; Longitudinal 119° 35' W

Elevation (Ground) 724 Feet

Obervations from 1912 to 1944 were by United States Weather Bureau Cooperative Observers at a site about 10 miles ENE of present location.

\# Less Than One-Half

\+ Also on Earlier Years

* Calories/cm²

Air Purity at Hanford

Limited data indicate that air at Hanford is very pure except for particulates.

1. Sulfur Oxide

Continuous monitoring of SO_2 content of air on the bluff opposite 300 Area and near Ringold is done by Hanford Environmental Health Foundation. At all times for the past two or three years SO_2 concentrations have been less than 0.005 ppm.

State of Washington Air Quality Standards specify that SO_2 in the air shall not exceed 0.020 ppm average for any one year nor 0.100 ppm average for any one day. Corresponding numbers for National Air Standards are 0.060 and 0.260 ppm.

2. Nitrogen Oxides

NO_2 concentrations in air at the same sampling stations used for SO_2 measurements show average values during a quarter ranging from 0.002 to 0.010 ppm, with a maximum observed value of 0.029 ppm during one 15-month period.

There are no Washington State Standards. National Air Quality Standard for nitrogen dioxide is 0.05 ppm annual arithmetic mean.

3. Particulates

Measurements of the particulate burden in air at a specific observation point in the 200 Areas at Hanford showed values of around 100 micrograms per cubic meter of air when the wind was less than 8 mph. The particulate content increased when higher winds were present, averaging 1,000 micrograms per cubic meter with winds of 12 mph, and 3,000 microgram per cubic meter with winds of 16 mph.

Washington Air Quality Standards specify that the suspended particulate concentration in ambient air shall not exceed 60 micrograms per cubic meter for more than 50% of the samples collected in any calendar year, nor more than 100 micrograms per cubic meter for more than 15% of the samples collected in any calendar month. National Air Quality Standards are 60 micrograms per cubic meter annual geometric mean and 150 micrograms per cubic meter maximum daily concentration.

(5) Provide a program and schedule to cover pre- and post-operational air quality monitoring and weather data on a continual basis. This program will be for a specific site and its nature will depend upon fuel to be used, contaminant potential and land characteristics and use and shall include contaminant emission monitoring when required by the appropriate agencies.

As part of the environmental surveillance program the Supply System will establish and place in operation a meteorological program including air sampling equipment for radiological monitoring. The meteorological program will be placed in operation at least two years prior to plant operation along with other parts of the environmental monitoring program, as set forth in Section 015(4), to establish background information for the Site. This part of the program will continue during the operational period of the plant.

Meteorology Local to the Site

The principal source of meteorological data previously reported in Subsection 030(4) is the 622-R Meteorology Tower, also known as the Hanford Meteorology Station (HMS) Tower. This tower is located 14 miles west northwest of the Site for Hanford No. 2.

Since 1969, meteorological data have been obtained for the FFTF Site,[1] which is only 2-1/2 miles south southwest of Hanford No. 2. These data should be representative of meteorological conditions at Hanford No. 2.

Large differences frequently occur in the values of the meteorological data of the FFTF Site and the HMS Tower. Wind direction distribution at the FFTF Site is bimodal while at the HMS there is only one predominant direction. These differences are illustrated by Figure 030-6.

(The reference report notes that the large percentage of readings at the 360° direction may be related to strip chart recorder characteristics and chart reading.)

For the FFTF Site, wind direction data for the months of December 1969 and June 1970 are shown in Figure 030-7. The large frequency of June winds from the direction of 250° is absent during December and the high frequency of winds around 310° during December is lacking during June.

FFTF wind velocity data for the months of December 1969 and June 1970 are summarized in the following table.

Percent Frequency of Wind Velocity at FFTF Site

Velocity						
Meters/second	Calm	1	2	3	4	5
Miles/hour	Calm	2.2	4.5	6.7	9.0	11.2
Frequency Data, %						
December 1969	10	46	34	8	2	-
June 1970	6	48	28	13	5	-

By comparison, winds at the 50 ft. height at the HMS Tower during June 1970 had the following velocity distribution:

Velocity (mph)	Calm	2.2	4.5	6.7	9.0	11.2
Wind frequency, %	5	10	15	13	17	7

Velocity (mph)	13.4	15.7	17.9	20.2	22.4	24.6-26.8
Wind frequency, %	10	7	6	4	2	3

The tabular data show that wind speeds at the FFTS Site are much less than those recorded at the HMS Tower. At the FFTF Site the higher frequency of winds with a velocity of 3 and 4 meters/second during June occurred during the afternoon hours, suggesting a diurnal effect of summer heating.

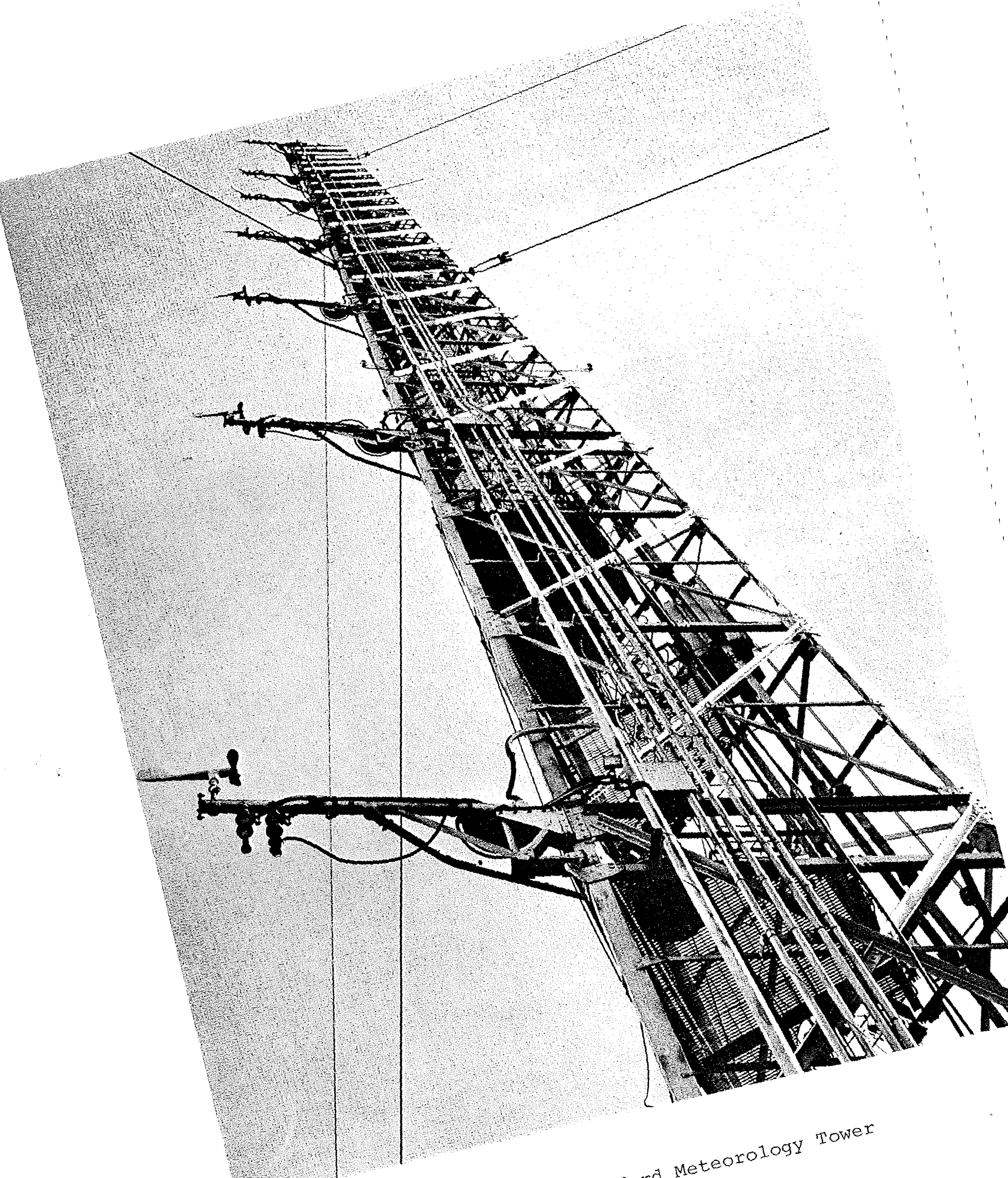
II. Meteorological Monitoring Program

Meteorological data for the Site of Hanford No. 2 will be obtained from a meteorological tower to be erected at the Site. The tower will be located on the west side of the turbine-generator building and will be 220 feet high which is 30 feet higher than the top of the reactor building. The tower will be used to obtain air velocity, direction, temperature and radioactivity data at two or more elevations.

This program will be commenced by at least March 1975, which is two years before the scheduled time for first loading fuel into the reactor. Meantime, meteorological data which should be reasonably well representative of the Site for Hanford No. 2 is being obtained at the FFTF Site.

It is planned to rely on programs supported by others, especially the Atomic Energy Commission, for meteorological data away from the immediate Site of Hanford No. 2. If these programs are dropped the Supply System will reactivate such programs as are appropriate.

Additional radiological air monitoring stations will be provided at the Site, but all meteorological data will be collected at the tower.



The 410-Foot Hanford Meteorology Tower

Figure 030-3

HANFORD METEOROLOGICAL SENSOR FACILITIES

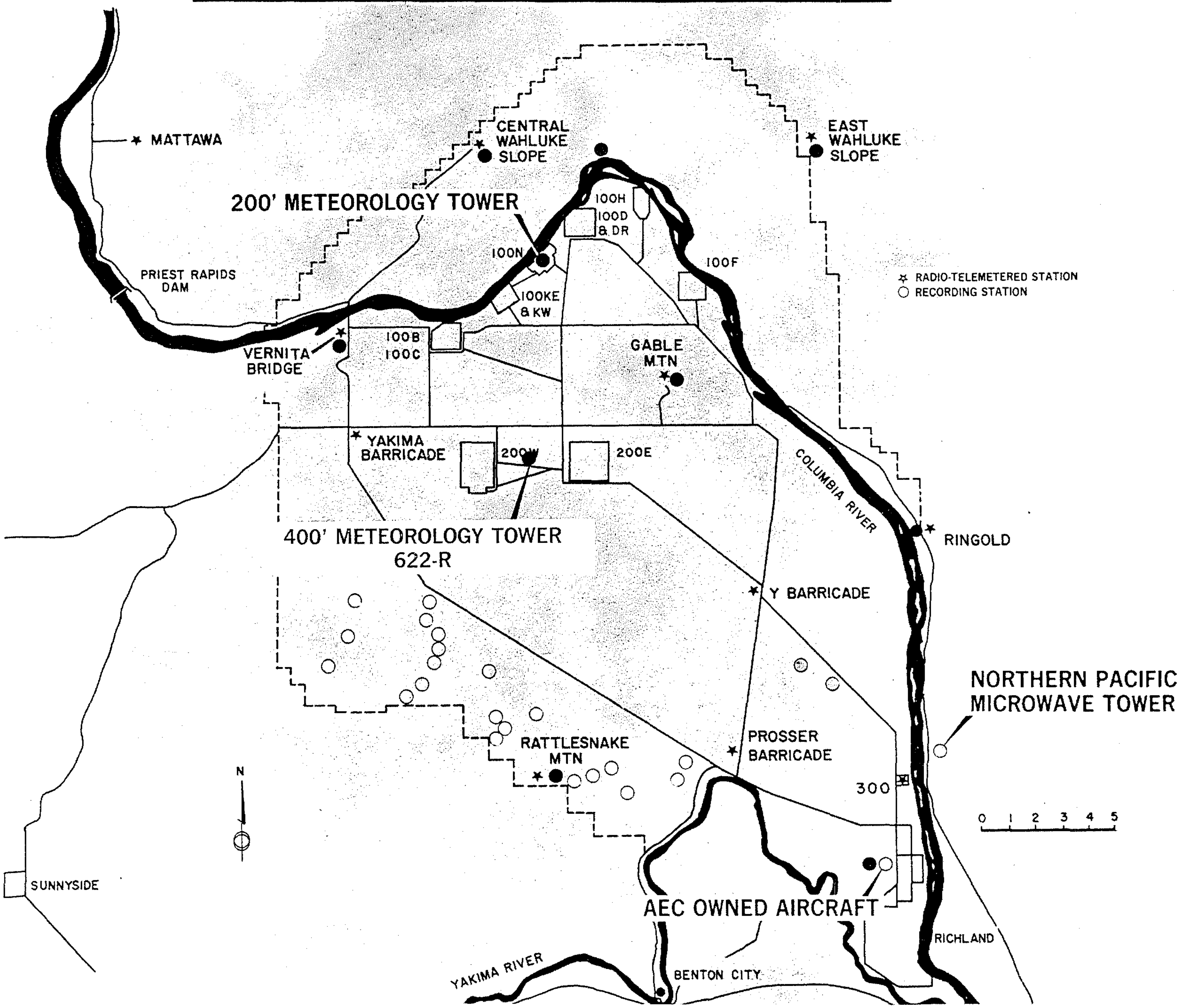
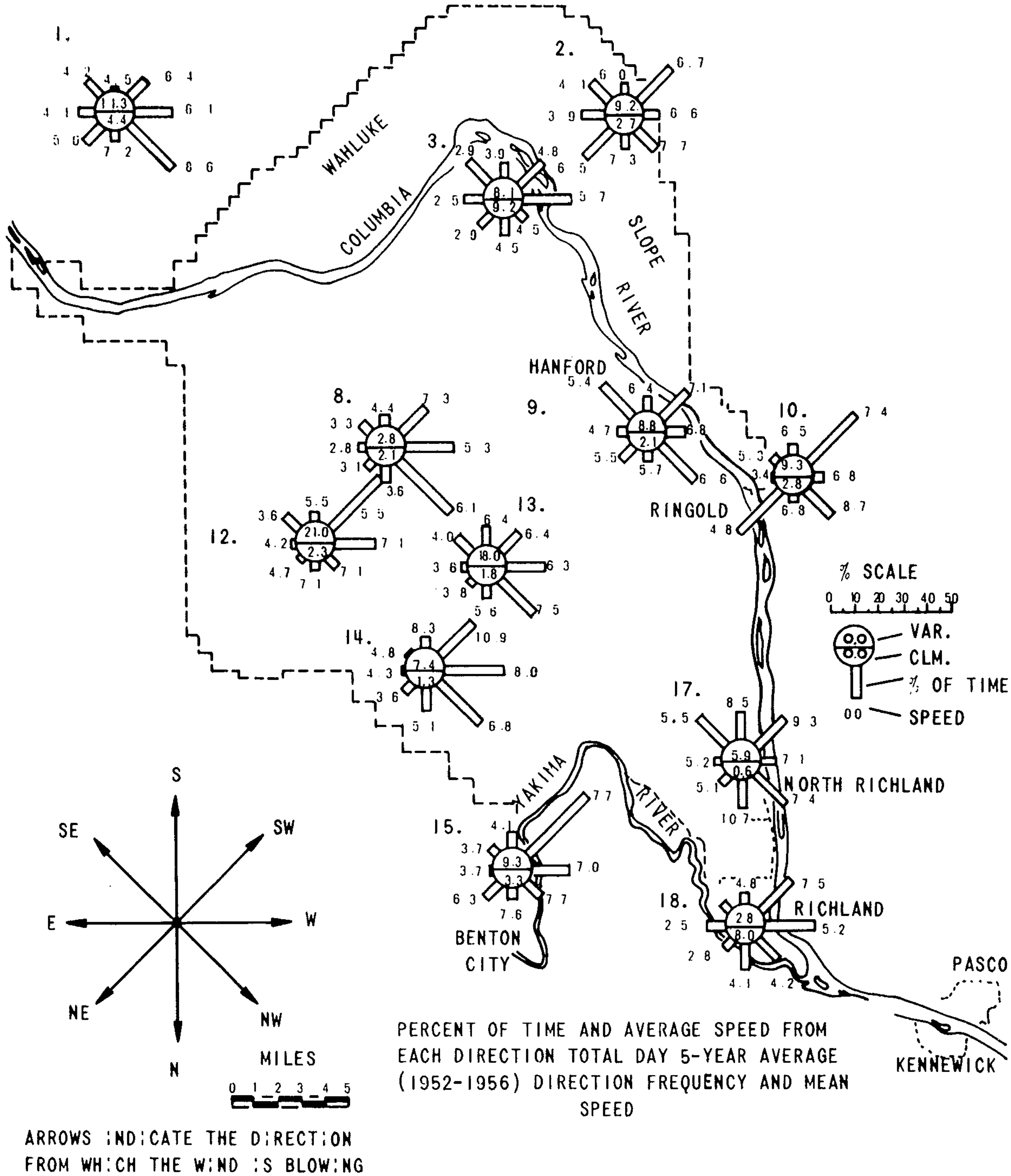


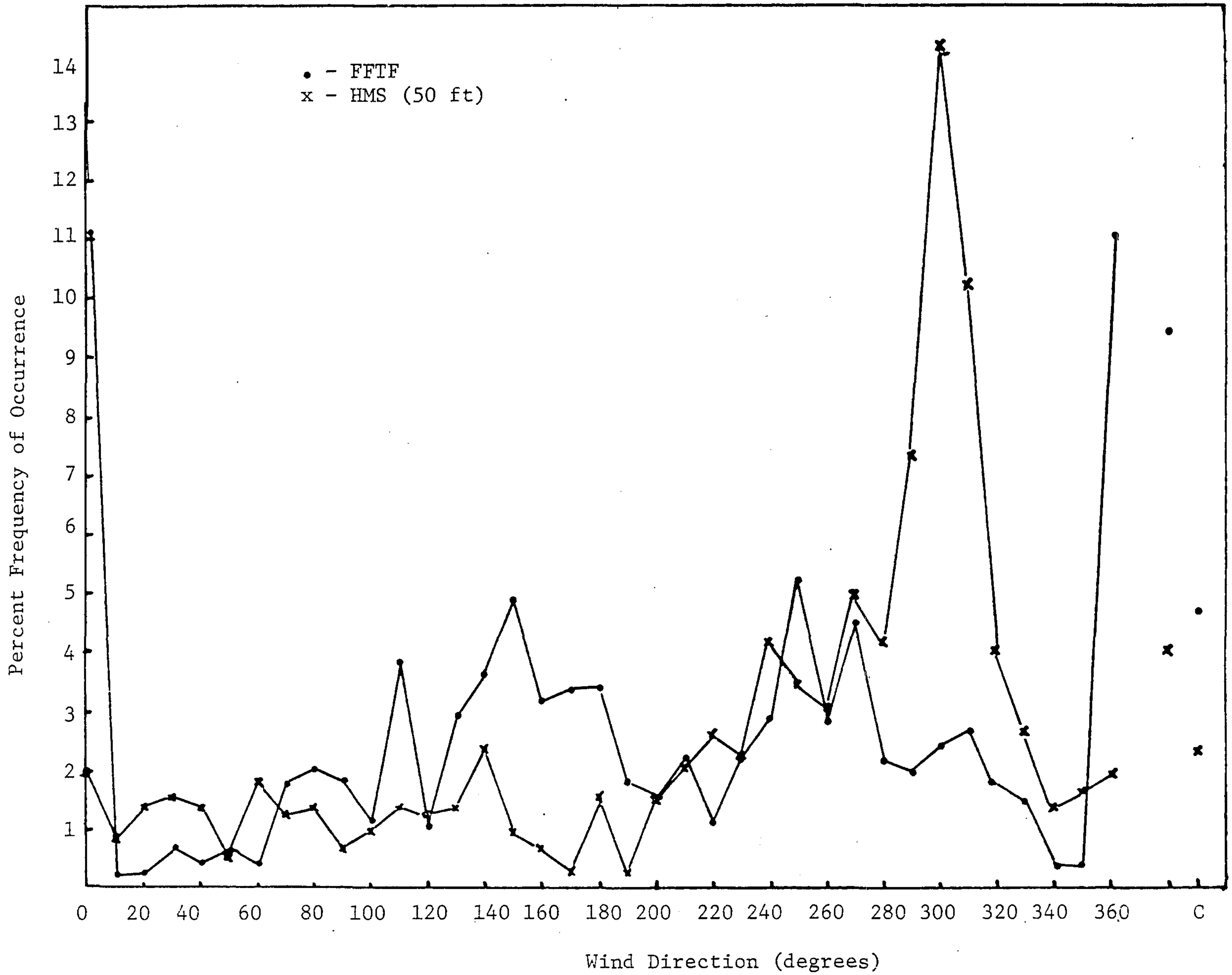
Figure 030-4



Wind Roses for the Hanford Reservation

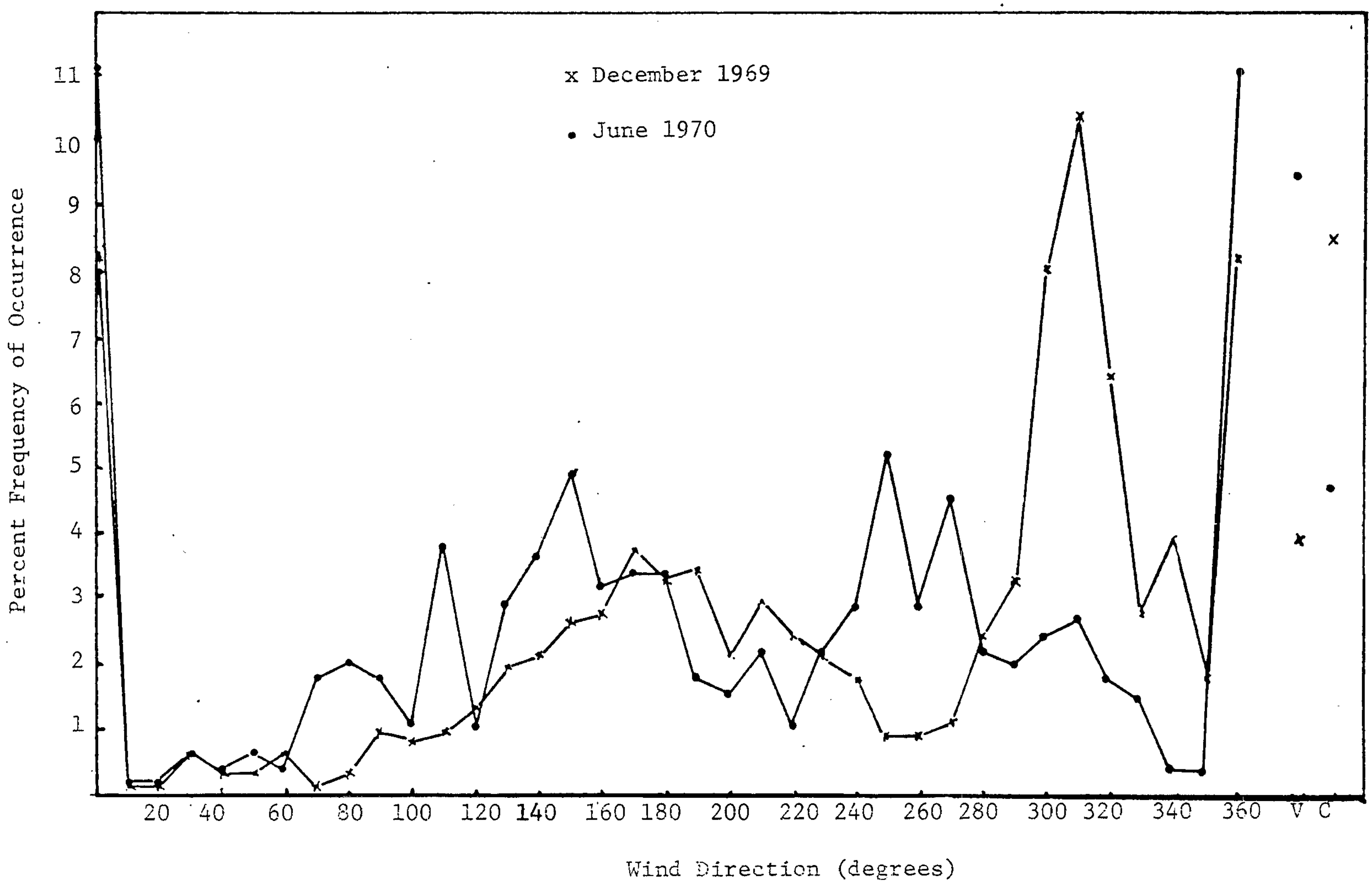
Figure 030-5

Figure 030-6

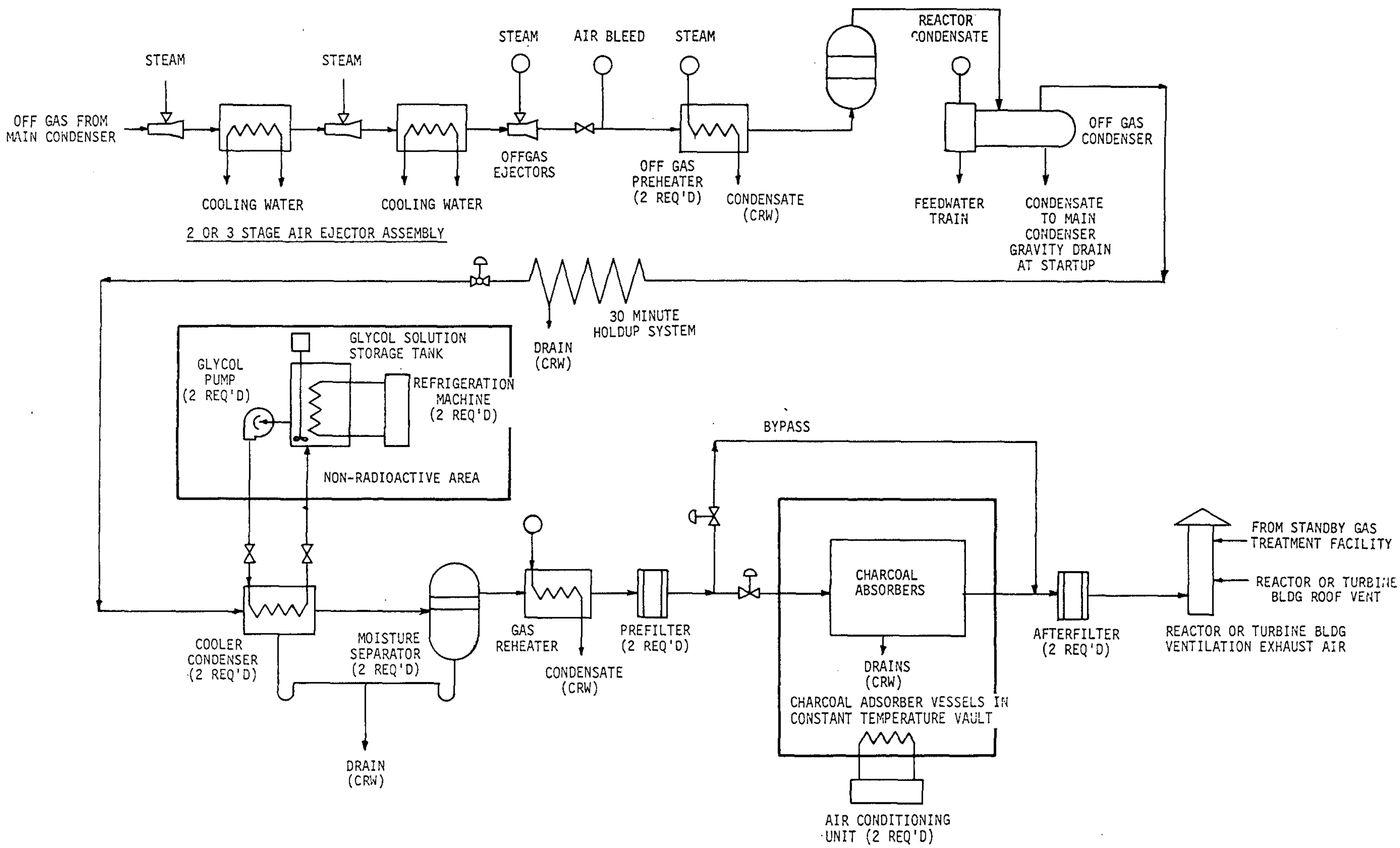


Percent Frequency Distribution of Wind Direction, FFTF and HMS 50 ft Level, June 1970.

Figure 030-7



Percent Frequency Distribution of Wind Direction, FFTF Site, December 1969 and June 1970.



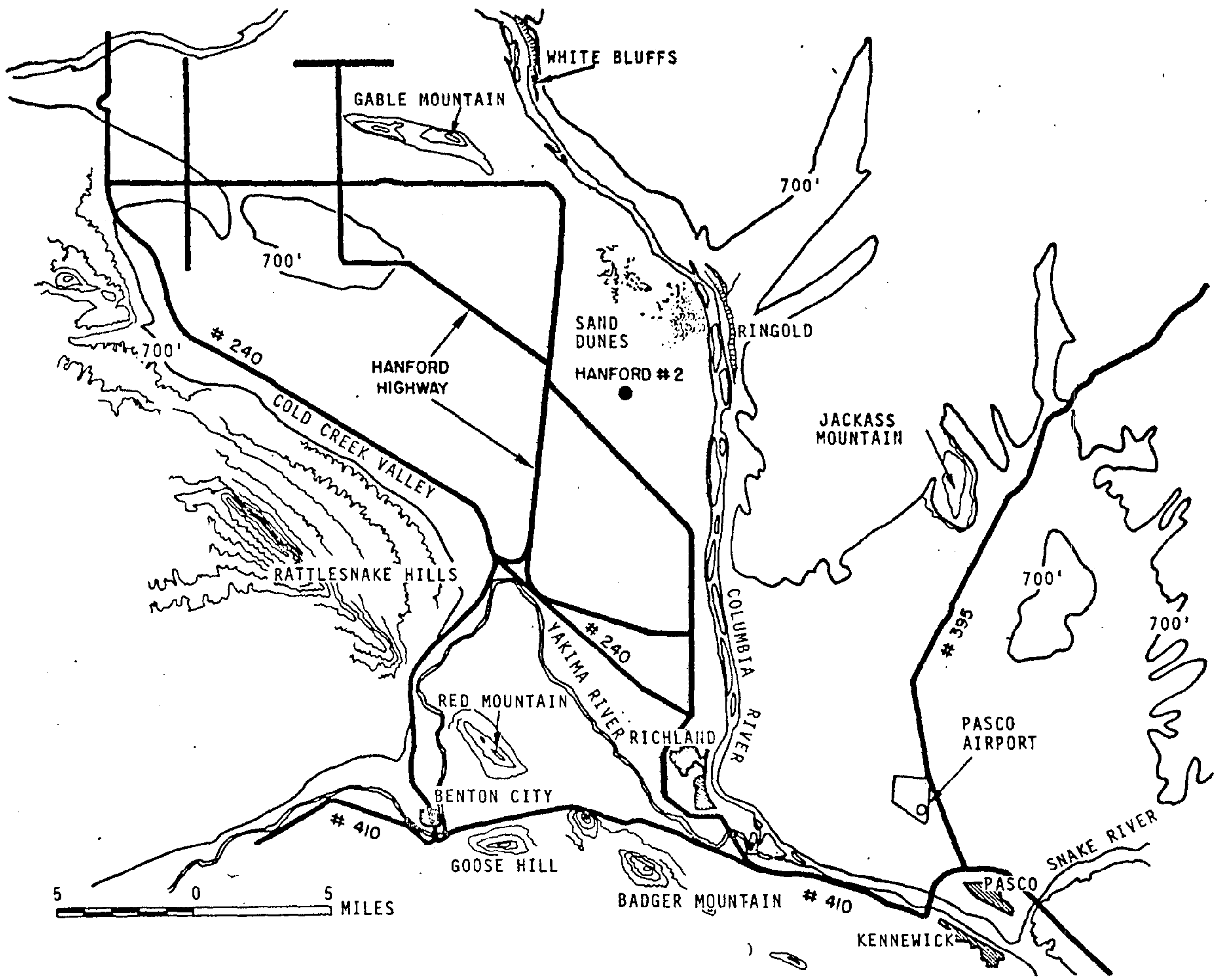
GASEOUS SYSTEM DESCRIPTION

Figure 030-8

Supp. Filing 7/1/71

FIGURE 030-10

Supp. Filing 9/27/71



Area Map - 700 ft msl Contour

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Section 035

Natural Resources

(1) Vegetation.

(a) Provide a description of vegetation, or other receptor, terrestrial and aquatic, which might potentially be affected by the design, construction and generation of the plant and design, installation and maintenance of associated transmission lines.

Due to the low annual rainfall of approximately 6.4 inches, the highest order of natural vegetation is sagebrush except in areas where irrigation has been introduced for agricultural purposes. The sagebrush is three to seven feet in height and interspersed with desert grasses. No agricultural crops are grown within a three and one-half mile radius of the Site.

Both migratory fowl, and marine life in the river, represent possible routes by which any contamination released from the Project could be transported to the environs with subsequent human ingestion. In particular, the uptake of ^{32}P by river algae and the later concentration of it by fish in the river are historically the subjects of careful and continued surveillance by the AEC contractors for operation of the AEC production reactors.[1]

The Project will be designed to incorporate facilities commercially demonstrated to minimize radioactive releases to the environment and will comply with AEC standards. The waste from the Project will be managed so that it will not aggravate or create problems of significant contamination to the vegetation, aquatic or terrestrial.

The Project will use a cooling pond as a means of cooling, drawing only makeup water from the Columbia River. Any discharges will be released to the river by controlled discharge or into diffusion wells, cribs or troughs.

Discharges to the river will be made under controlled conditions in which some heated effluent may be discharged, but it will amount to a very small quantity, in the order of 10-15 cfs. This compares with an absolute minimum Columbia River flow of 36,000 cfs and a normal minimum flow in the order of 90,000 cfs. The resulting dilution factor will preclude any measurable detrimental effect to the aquatic vegetation.

Transmission lines from the Site will make connection to the Bonneville Power Administration's 500 kv switchyard in the 100-N Area of the Hanford Reservation adjacent to the existing generating plant. The terrain to be crossed is of the same description as the Project site and the 500 kv transmission line will be that described in Section 010 (4). There are no significant vegetative natural resources that will be disturbed.

A description of the principal vegetation, terrestrial and aquatic, on the Hanford Reservation is included in Tables 035(1a)-1 and 035(1a)-2.

A tabulation of the type and acreage of food and feed crops in the South District of the Columbia Basin Irrigation Project is tabulated on page 4, Section 010(1d).

The sampling and monitoring program of vegetative species is included in Section 015(4) and is also discussed in Section 035(1)(b).

TABLE 035(1a)-1

Species List for the Hanford Environs

Aquatic Vegetative Media

Plants
- Algae
- Class Clorophyceae - Green Algae
  - *Tetraspora* spp.
  - *Stigeoclonium* spp.
  - *Cladophora* spp.
  - *Oedogonium* spp.
  - *Ulothrix* spp.
  - *Spirogyra* spp.
- Class Chrysophyceae - Golden-Brown Algae
  - *Hydrurus foetidus*
- Class Bacillariophyceae - Diatoms
  - *Melosira* spp.) dominant planktonic forms
  - *Tabellaria* spp.)
  - *Fragilaria* spp.)
  - *Asterionella formosa*)
  - *Gonphonema* spp.) dominant sessile forms
  - *Cymbella* spp.)
- Class Myxophyceae - Blue-Green Algae
  - *Ocillatoria* spp.
  - *Phormidium* spp.

Vascular Aquatic Plants
- Water Nymphs Family - Najadaceae
  - *Potomogeton* spp.
- Frog's-Bit Family - Hydrocharitacae
  - *Elodea* spp.
- Duckweed Family - Lemnaceae
  - *Lemna* spp.
- Buchwheat Family - Polygonaceae
  - *Polygonum* spp.
- Hornwort Family - Ceratophyllaceae
  - *Ceratophyllum demersum*

TABLE 035(1a)-2

Terrestrial Plants and Animals

Plants	
Shrubs	
Big sagebrush	Artemesia tridentata
Bitterbrush	Purshia tridentata
Green rabbitbrush	Chrysothamnus viscidiflorus
Gray rabbitbrush	C. nauseosus
Spiny hopsage	Grayia spinosa
Snow Eriogonum	Eriogonum niveum
Forbs	
Longleaf phlox	Phlox longifolia
Balsamroot	Balsamorhiza careyana
Sand dock	Rumex venosus
Scurt pea	Psoralea lanceolata
Lupine	Lupinus laxiflorus
Pale evening primrose	Oenothera pullida
Desert mallow	Sphaeralcea munroana
Cluster lily	Brodiaea douglasii
Sego lily	Calochortus macrocarpus
Tansy mustard	Descurainea pinnata
Tumble mustard	Sisymbrium altissimum
Cryptantha	Cryptantha circumscissa
Russian thistle	Salsola kali
Fleabane	Erigeron filifolius
Grasses	
Sandberg bluegrass	Poa sandbergii
Cheatgrass	Bromus tectorum
Indian ricegrass	Oryzopsis hymenoides
Squirrel tail	Sitanion hystrix
Six weeks fescue	Festuca octoflora
Thickspike wheatgrass	Agropyron dasystachum
Riprarian Vegetation	
Willow	Salix exigua and others
Cottonwood	Populus trichocarpa
Sedges	Carex spp.
Rushes	Juncus sp.
Horsetail	Equisetum sp.
Cocklebur	Xanthium sp.
Wild onion	Allium sp.

(1) Vegetation.

(b) Develop a pre- and post-operational environmental quality surveillance program of the appropriate receptor media, terrestrial and aquatic.

A pre-operational and post-operational environmental quality surveillance program will be conducted for the project pursuant to 10 CFR Part 20.

The radiological surveillance program will be supplemented with other surveillance programs which evaluate environmental effects resulting from plant operation.

This program will build upon the extensive surveillance of the Hanford environs which has been carried on for more than twenty years.

During the 26 years since the world's first production reactor went into operation at Hanford, data and operating experience for the control of thermal, radioactive, and chemical effluents has been gathered constantly with full cognizance of their environmental effects.

The Columbia River Ecology Program conducted at Hanford has been designed to produce sufficient knowledge of the local reach of the river to understand the cycling of minerals and the fate of radio-nuclides introduced into systems, predict changes in characteristics of the biomass with alteration of the basic hydrologic and water quality parameters, quantify the biological cost of introducing radioactive and other pollutants into the systems, and extrapolate the results developed for the Columbia River System to other rivers. Information gathered during the past two to three decades represents a substantial quantity of hydrologic, physical, chemical, and biological data.

This comprehensive surveillance has been associated with a variety of research studies such as investigation of physical dispersion of effluents in relation to agricultural areas and population centers, investigation of areas of accumulation that might conceivably develop into problems at some future time, and investigations of the pathways that any particular contaminants follow through the environment from points of release to places where they may interact with people or affect the ecology.

Field measurements and the collection of field samples are basic parts of the environmental evaluation program and a great variety of equipment is in continual or frequent use in connection with studies of the AEC's Hanford effluents. The programming techniques, design of instrumentation, and the collection and interpretation of data have been continuously improved over the past 26 years and in many cases have contributed to the national standard used in environmental study and surveillance.

For collection of samples in the atmosphere, an extensive network of fixed and portable stations is operated both within the Reservation and offsite up to distances of more than 100 miles. A typical station contains equipment for drawing metered volumes of air through high-efficiency filters, absorbers, and/or scrubbing solutions so that selected contaminants of interest are retained for subsequent analysis in the laboratory.

The groundwater monitoring program of the AEC at Hanford has supplied a 23 year historical record of comprehensive water and water movement data which has proved invaluable in research as well as in operations-oriented studies. In particular, the delay of radioactive ions in travel with groundwater and the holdup by ion-exchange in the soil particles has been well recognized and understood.

as in operations-oriented studies. In particular, the delay of radioactive ions in travel with groundwater and the holdup by ion-exchange in the soil particles has been well recognized and understood.

WAC 463-12-035(1)(b) - QUALITY OF THE ENVIRONMENT - NATURAL RESOURCES - VEGETATION (Supp. Filing 8/20/71)

The Environmental Radiological Monitoring Program is described in Section 015(4) - Health and Safety. This program includes the radiological monitoring of all aquatic and terrestrial food chain constituents as well as airborne particulates, well waters, surface waters, bottom organisms, milk, eggs, vegetation, soil and terrestrial and aquatic wildlife.

Section 015(4) also provides information pertinent to the pre- and post-operation air and water quality monitoring program discussed in Section 025(2)(g) and Section 030(3) respectively.

In addition to the Environmental Radiological Monitoring Program, the Supply System will also conduct a non-radiological environmental monitoring program. This program will include annual inspections of the terrestrial and aquatic receptor media, including the type and abundance of natural vegetation.

Since the radioactive content of discharges from Hanford No. 2 will be less than one percent of 10 CFR 20 limits and other restraints are placed on plans for construction and operation, as discussed elsewhere in this application, there should be no measurable long term effect on the vegetation due to Hanford No. 2.

A description of the preoperational and operational environmental monitoring program for soil and vegetative sampling and surveillance is contained in Section 015(4).

Terrestrial Vegetative Sampling

The sample types and frequencies of terrestrial vegetative media includes natural vegetation, food crops, feed crops, as well as observations of any physical changes in the nature of the indigenous flora in the plant environs resulting from such effects as water vapor transport to the vegetation.

Aquatic Vegetation

The sampling program of aquatic vegetation included in the environmental radiological monitoring program in Section 015(4), includes rooted aquatic plants, algae, and riverbottom sediments. The frequency of the aquatic vegetative sampling in both the preoperational and operational phases of the surveillance program is discussed in Section 015(4).

A list of principal aquatic and terrestrial vegetative media is contained in Table 035.1a-1 and Table 035.1a-2, respectively.

(2) Fish and Wildlife.

(a) Provide plans for fish protection facilities that assure maximum protection to the resource. These facilities shall include, but are not limited to, fish screens at the water intake and discharge, water intake and discharge design that minimize fish attraction, and a system to by-pass fish safely to natural waters.

Prior to completion of project design of the water intake and discharge facilities, the Supply System will provide necessary investigations and studies to determine required fish protection facilities for the water intake at the pumphouse.

Intake Facility - Fish Protection

As described in Section 025 (2b) - pages 2-4, the intake for makeup water to the cooling systems will be of the infiltration type with water entering the pumping system through a filter bed and perforated pipe along the west side of the Columbia River. Details of the proposed intake and pump structure are shown on Figures 025-6 and 025-7.

(2) Fish and Wildlife.

(a) Provide plans for fish protection facilities that assure maximum protection to the resource. These facilities shall include, but are not limited to, fish screens at the water intake and discharge, water intake and discharge design that minimizes fish attraction, and a system to by-pass fish safely to natural waters.

Prior to completion of project design of the water intake and discharge facilities, the Supply System will provide necessary investigations and studies to determine required fish protection facilities for the water intake at the pumphouse.

Fish protection facilities in the cooling water intake facility will include (1) traveling water screens of approximately 3/8" mesh, to limit intake of fish; (2) minimal approach velocities in the order of 0.5-1.0 feet per second to minimize fish attraction and impingement; (3) bypass ports to bypass fish in proximity to the screens; (4) river return for trash or other accumulations deposited from the screen wash mechanism; (5) other measures such as lighting control, etc., as required to assure maximum protection to the resource.

Discharges from offstream cooling facilities will be managed according to the standards of State Pollution Control Board as regarding effluents and thermal mixing.

The specific reason the Supply System adopted a filtration system for the water intake facility was for the purpose of assuring maximum protection of the fishery resource. Such an intake filtration system avoids fish attraction characteristics of a conventional screened pumphouse, reduces approach velocities and obviates the requirement for bypass ports, screen wash mechanisms and trash handling. The Supply System's plans for the water intake structure and outfall facility have been reviewed with the Department of Fisheries to assure that there will be maximum protection of the fisheries' resource.

Discharge Facility - Fish Protection

Once through direct cooling by water from the Columbia River was eliminated from consideration in the early stages of Hanford No. 2 design due to environmental considerations and water quality criteria established by the State of Washington.

The cooling tower evaporation process results in concentrating the salts and suspended material in the river water and it is necessary to "blowdown" the cooling tower basins to maintain a reasonable concentration of the non-volatile river water components. The concentrated material is in suspension and returned to the river via the discharge facility.

Section 025 (2)(e) contains a description of the chemical treatment and mineral concentration of the water in the condenser cooling system.

A calculation of the dilution zone for Hanford No. 2 discharge facility is being prepared by Battelle and filed as a supplement to Section 025 (2)(c).

(2) Fish and Wildlife.

(b) Provide acceptable research or study plans for determining the abundance of, distribution of, and project effects on wildlife, fish and other aquatic life, in the proposed project influence area.

Numerous studies have been conducted and are in progress on an on-going basis. The Battelle Northwest Laboratory is conducting bioenvironmental research programs in terrestrial and aquatic ecology at Hanford and elsewhere within limitations of available funding, personnel and equipment.(2) The AEC has been the principal supporter of the research performed to date.

The abundance and distribution of wildlife, fish and other aquatic species have been documented over many years of Hanford operation. A sampling of studies conducted for the Hanford area on Wildlife, Fish and Other Aquatic Life are:

Abundance and Distribution of Wildlife

In 1968 W. C. Hanson of Battelle Northwest reported on the cover type and nesting habitat measurements of the Columbia River Islands, and riparian habitat for geese within the Hanford Reservation.(3) The report included the 19th annual goose nesting survey. Banding of about two thousand birds of eight species, and weekly aerial census of wintering waterfowl were taken in the Hanford reach of the Columbia River. A continuing program studying the population data is expected to evaluate various ecological and population phenomena that may indicate causal factors, and serve as an invaluable fund of basic biological information with future applications in resource management.

The Arid Lands Ecology Reserve of 120 square miles is providing the opportunity to study a vast area without destroying it. The first steps of the studies have been underway for approximately four years, and the objects are to determine what animals and plants live there, what community they live in, types of soil, vegetation and climates.

The Study of Ground Dwelling Beetles in Abandoned Agricultural Fields has already provided a wealth of information concerning the biomass, and species composition on a 25 year old abandoned cultivated field area similar in characteristics to that of the Project site area. "The Pristine plant communities in the Rattlesnake Hills are dominated by big sagebrush, Artemisia tridentata with bluebunch wheatgrass, Agropyron spicatum as the dominant understory herb. Abandoned cultivated fields support annual grasses and herbs of which cheatgrass brome, Bromus tectorum, is usually the dominant species."[4]

In the ALE studies, to date, it has been determined that mice are the most successful vertebrates in the area, with a combined body weight of 4 pounds per acre.[5] Other backboned animals - jackrabbits, snakes, coyotes, deer - live on the project but are not numerous enough to match the weight per acre of the mice. The pocket mouse is the most numerous. Several other kinds inhabit the area in smaller numbers, including the predatory grasshopper mouse. The invertebrate, cold-blooded darkling beetle is the most successful creature on the Reservation. Some years, the combined weight of the beetles is 20 pounds per acre - far greater than that of any other creatures. The beetles' food supply is underground roots.

In the Hanford Reservation porcupine, raccoon, muskrat, mink, beaver, bobcat, and stray domestic cat have been observed from time to time in addition to the wildlife identified in the ALE study area. The following have been reported by the Fish and Wildlife Service:(6)

Big Game

Approximately 250 mule deer inhabit the AEC Reservation lands. Principal deer use is on Columbia River islands and in cover along the stream's west bank. Islands in the river are important deer fawning grounds. They range out from riparian cover to feed on other adjoining AEC lands. In late summer deer frequent the more distant Rattlesnake Hills and in winter they return to the Project area for food and cover. The U. S. Department of Interior, Fish and Wildlife Service reports that "Deer are not adequately harvested at the present time."(6)

Upland Game

"Food and cover on the project area supports moderate to relatively dense populations of California quail, chukar, ring-necked pheasant, mourning doves and sage grouse. California quail are the most abundant. During the 1967-68 season hunting was allowed for the first time on 4,000 acres of AEC lands within the project area. These lands are located upstream from Ringold Flats and are managed by the Bureau of Sport Fisheries and Wildlife as a part of McNary National Wildlife Refuge. During 48 days of hunting 2,382 hunters were checked in. Of these 961 hunted upland game and harvested 800 California quail, 175 ring-necked pheasant and 14 chukar."

Fur Animals

"Fur animal populations are low within the project area. Beaver are the most plentiful and a few mink, muskrat, and raccoon are present. There is no present fur animal harvest."

Waterfowl

"Peak winter populations observed in the area have been as high as 18,000 geese and 300,000 duck. The resident waterfowl population is comparatively small.

"Approximately 280 pair of nesting geese produce 900 goslings annually on islands in the reservation. This constitutes about one-seventh of Washington's total goose production. Duck population in the reservation area is estimated to add 2,500 birds to the fall flight annually. The 20 islands of the area have been censused annually since 1950."

Other Wildlife

"A variety of nongame birds and other wildlife use the Reservation area. Gull colonies on two islands in the area are of particular interest. One of these colonies contains approximately 2,500 birds."

A survey was taken December 1969 by the Lower Columbia Basin Audubon Society for bird species within a 15 mile radius of the Columbia Park in the Tri-Cities area, approximately 20 miles southeast of the Project site. The report of the survey appears in the Audubon Field Notes, April, 1970.[7]

✓ Common Loon, 4; Horned Grebe, 1; Eared Grebe, 1; Western Grebe, 2; Pied-billed Grebe, 7; Great Blue Heron, 3; Canada Goose, 1188; Mallard, 1342; Pintail, 7; Green-winged Teal, 19; Am. Widgeon, 399; Shoveler, 1; Redhead, 15; Ring-necked Duck, 5; Canvasback, 4; Lesser Scaup, 37; Common Goldeneye, 39; Barrow's Goldeneye, 4; Bufflehead, 8; Common Merganser, 5; Sharp-shinned Hawk, 2; Cooper's Hawk, 3; Red-tailed Hawk, 1; Rough-legged Hawk, 2; Golden Eagle, 1; Marsh Hawk, 12; Sparrow Hawk, 10; California Quail, 297; Ring-necked Pheasant, 46; Am. Coot, 273; Killdeer, 19; Common Snipe, 6; **Dunlin, 24;** Herring Gull, 12; California Gull, 20; Ring-billed Gull, 198; gull (sp.), 27; Mourning Dove, 71; Burrowing Owl, 1; Short-eared Owl, 2; Red-shafted Flicker, 88; Black-billed Magpie, 65; Common Crow, 126; Red-breasted Nuthatch, 3; Bewick's Wren, 2; Long-billed **Marsh Wren, 12**; Robin, 87; Bohemian Waxwing, 8; Cedar Waxwing, 20; Northern Shrike, 1; Loggerhead Shrike, 7; Starling, 8512; **Hutton's Vireo, 1** (12-ft. study—W.H.); Audubon's Warbler, 54; House Sparrow, 480; Western Meadowlark, 42; Red-winged Blackbird, 11; Brewer's Blackbird, 39; Evening Grosbeak, 1; House Finch, 140; Am. Goldfinch, 128; Slate-colored Junco, 6; Oregon Junco, 59; **Tree Sparrow, 25** (carefully by 3); White-crowned Sparrow, 466; Fox Sparrow, 16; Song Sparrow, 28.

Total, 66 species; about 14,545 individuals. (Seen in area count period, but not on count day: **Blue Goose, Greater Scaup,** Pigeon Hawk, Hairy Woodpecker, **Pine Siskin.)**

Occasionally seen but not reported in the Field Notes are Chukar Partridge, Goshawk,[8] Prairie Falcon, Peregrin Falcon,[8] Sage Grouse, Snow Geese, and Gadwall.

Fisheries

Battelle Northwest Laboratory crews recorded location or migration paths of 368 tagged fish between May and October 1968. Of these 89 were spring and summer Chinook and 279 were summer Steelhead. This was a follow-on study of observations made in

1967. Infrared studies were carried out by J. R. Eliason of the Water and Land Resources Department. Conclusions of the report[9] were:

"As in 1967, chinook and steelhead migrated along shorelines, with the left bank being most frequently utilized during the peak seasonal temperatures. Few fish encountered maximum temperatures of the principal, mid-river outfalls. No statistical difference was found between migration rates of each species or between rates along shorelines believed to be influenced or not influenced by reactor discharges. The latter may be a function of the selection of areas to be compared, however, and may not be accurate for all specific shoreline zones. Further analyses will be required. Average migration rates and the daily frequencies of point locations of fish per river kilometer were distinctly non-uniform throughout the river reach between the B-C reactor area and River Mile 375. Differences may be reasonably attributed to shoreline features such as swift, unprotected zones (km 37-38) or backeddies (km 28), or they may be related to reactor operations. Insufficient data are available at present to positively identify the causes of anomalies in distribution and migration rate. A temperature-sensitive sonic tag is almost essential for relating fish movements to specific water temperature levels in a dynamic river system such as the Columbia."[9]

Also reported on in 1968 was a study of "The Food and Feeding of Juvenile Chinook Salmon in the Columbia River at Hanford" by C. D. Becher of the Battelle Northwest Laboratories.[10] Conclusions of the report are:

"Young chinook salmon in a free-flowing section of the Columbia River in the Hanford Environs, feed primarily upon semi-aquatic insects and secondarily on terrestrial insects. There is no evidence that heated effluents discharge in midstream plumes, which rapidly mix with the colder river water, adversely affect either insect production or the feeding activity of the fish. Food intake was restricted, however, in a few areas receiving heated water via intragravel seepage from shoreline retention basins in April and early May; these areas were inundated by subsequent rise in river discharge during the annual spring runoff. Increments to the thermal regime of the Columbia in early spring, when water temperatures are below the preferred level of juvenile salmonids (12 to 14°C), are not harmful and may actually benefit the fish."

"The most important food item identified in the stomachs of young chinook collected in the Hanford reach were chironomids".[10]

Other areas studied in 1968 as part of the continuing Aquatic

Ecology program can be found in reference (1) of this Section.

Tables 035.2-1 through 3 were provided the Supply System by the Battelle Northwest Laboratories. The tables are by no means a complete list of the aquatic forms in the Hanford section of the Columbia River, particularly the invertebrates, but describe the major species found.

Project Effects

The radiological monitoring program of the Supply System will include studies to identify any measurable effects on wildlife, fish and other aquatic species due to plant operation. Supply System survey programs and other post-operational surveillance programs (including periodic census counts) will build upon the surveillance work of the other agencies doing parallel or complementary work. A review to determine any effect of Project operation on fish and wildlife indigenous to the proposed Project site will be made and reported upon as required.

TABLE 035.2-1

PLANT KINGDOM

PHYLUM CHLOROPHYTA "Green Algae"

Class Chlorophyceae

Tetrospora spp	
Stigeoclonium spp	
Cladophora spp	
Oedogonium spp	"Filamentous Green Algae" (dominant forms)
Ulothrix spp	
Spirogyra spp	

PHYLUM CHRYSOPHYTA

Class Chrysophyceae "Golden-Brown Algae"

Hydrurus foetidus (Vill.) Trev.

Class Bacillariophyceae "Diatoms"

Melosira spp	
Tabellaria spp	
Fragilaria spp	"Plankton" (dominant forms)
Asterionella formosa Hass.	
Gonphonema spp	"Sessile Diatoms" (dominant forms)
Cymbella spp	

PHYLUM CYANOPHYTA "Blue-Green Algae"

Class Myxophyceae

Oscillatoria spp	"Filamentous Blue-Green Algae"
Phormidium spp	

PHYLUM SPERMATOPHYTA

Family Potomogetonaceae

Potomogeton spp

Family Vallisneriaceae

Elodea sp

Family Lemnaceae

Lemna sp

Family Polygonaceae

Polygonum

Family Ceratophyllaceae

Ceratophyllum demersum L.

TABLE 035.2-2

ANIMAL KINGDOM

PHYLUM PORIFERA "Sponge"

Spongilla spp Fresh Water Sponge

PHYLUM COELENTERATA

Hydra sp

PHYLUM PLATYHELMINTHES "Flat Worms"

Dugesia dorotocephala (Woodworth)

PHYLUM BRYOZOA

Plumatella sp

PHYLUM ANNELIDA

Oligochaetae

Leeches

PHYLUM MOLLUSCA

Class Pelecypoda "Clams"

Anodonta nuttalliana Lea "Fresh-Water Mussel"

Cyclas fluminea (Muller)

Class Gastropoda "Snails"

Stagnicola spp

Physa nuttallii (Lea)

Fluminicola nuttalliana (Lea)

Fisherola nuttallii (Haldeman) "Limpets"

PHYLUM ARTHROPODA

Class Crustacea

Cladocera "Water Fleas"

Astacus trowbridgii Stimpson "Crayfish"

Class Insecta "Insects"

"True Bugs"

Sigara sp "Water Boatman"

"Mayflies"

Paraleptophlebia bicornuta McDunnough

Baetis

"Stoneflies"

Arcynopteryx paralla (Frison)

"Caddis Flies"

Glossosoma velona Ross

Hydropsyche spp

Cheumatopsyche spp

Hydroptila argosa Ross "Microcaddis Fly"

Brachycentrus occidentalis Banks

"Moths and Butterflies"

Argyractis angulatalis Lederer "Aquatic Moth"

"Beetles"

Gyrinus sp "Whirligig Beetle"

"True Flies"

Tipulidae "Cranefly"

Chironomidae "Bloodworm Midges"

Orthocladiinae "Midges"

Simulium spp "Blackflies"

Class Arachnida

Hydracarina "Water Mites"

TABLE 035.2-3

FISH

Common Name	Scientific Name
Pacific Lamprey	Lampetra tridentata (Gairdner)
White Sturgeon	Acipenser transmontanus Richardson
Chinook Salmon	Oncorhynchus tshawytscha (Walbaum)
Sockeye or Blueback Salmon	O. nerka (Walbaum)
Coho or Silver Salmon	O. kisutch (Walbaum)
Steelhead or Rainbow Trout	Salmo gairdneri Richardson
Cutthroat Trout	S. clarki Richardson
Dolly Varden	Salvelinus malma (Walbaum)
Mountain Whitefish	Prosopium williamsoni (Girard)
American Shad	Alosa sapidissima (Wilson)
Mountain Sucker	Pantosteus platyrhynchus (Cope)
Bridgelip Sucker	Catostomus columbianus (Eigenmann & Eigenmann)
Largescale Sucker	Catostomus macrocheilus Girard
Carp	Cyprinus carpio Linnaeus
Redside Shiner	Richardsonius balteatus (Richardson)
Northern Squawfish	Ptychocheilus oregonensis (Richardson)
Chiselmouth	Acrocheilus alutaceus Agassiz & Pickering
Peamouth	Myiocheilus caurinus (Richardson)
Blacknose Dace	Rhinichthys atratulus (Hermann)
Longnose Dace	R. cataractae (Valenciennes)
Speckled Dace	R. osculus (Girard)
Brown Bullhead	lctalurus nebulosus (Le Sueur)
Black Bullhead	l. melas (Rafinesque)
Channel Catfish	l. punctatus (Rafinesque)
Threespine Stickleback	Gasterosteus aculeatus Linnaeus
Yellow Perch	Perca flavescens (Mitchill)
Walleye	Stizostedion vitreum (Mitchill)
Bluegill	Lepomis macrochirus Rafinesque
Pumpkinseed	L. gibbosus (Linnaeus)
White Crappie	Pomoxis annularis Rafinesque
Black Crappie	P. nigromaculatus (Le Sueur)
Largemouth Bass	Micropterus salmoides (Lácepède)
Smallmouth Bass	M. dolomieui Lácepède
Sculpin	Cottus spp.

Trend Indicator-Terrestrial

The assimilation of airborne contamination by native fauna has been studied at the Hanford Project since 1946. Initially, radioactive waste discharge into the atomosphere during the plutonium manufacturing processes were the only radioactive contaminants introduced into the terrestrial environment. Radioiodine was the most important, and often the only radioisotope detectable above the natural radiation background and tissues of upland animals.(11)

Routine sampling of animals from the Hanford environment was originally programmed to monitor contamination of organisms by Hanford effluents. The initiation of nuclear weapons tests by the United States and other nations introduced additional important sources of airborne radioactive contamination, and required that the surveillance program not only determine as accurately as possible the amounts of radioactivity in the animals, but also to attempt discrimination between the fraction from the Hanford Project and that originating elsewhere.

Blacktail jackrabbits were selected as the standard animal for collection because they have food habits similar to larger range animals, their home range is sufficiently small to allow comparison among data of several stations, they are available throughout the year at all sampling locations, and they have thyroid glands of sufficient size to permit reliable counting rates with standard beta-gamma counting equipment.(11)

Other mammals, birds and reptiles were collected periodically for comparison of radioisotopic concentrations between various kinds of animals and food habit types during the study referenced above.

The environmental radiological monitoring program, including sample types, sample stations, sample frequency and types of analysis are summarized in Table 015(4)-1.

Important Species - Aquatic

The Columbia River is popular for sports fishing, both above and below the Hanford Reservation. Fish feeding downstream from the reactors have historically acquired, through the food chains, some radionuclides originating from up to eight plutonium production reactors and one dual purpose reactor. Radio phosphorous (^{32}P) is the most significant nuclide with regard to population doses. Whitefish are the sport fish which usually contain the greater concentration of radioactive materials. Furthermore, they can be caught during winter months, when other sport fish are difficult to sample. ^{32}P data accumulated from white fish sampling near the Hanford boundary are useful as a long-term trend indicator of concentrations in biological media, even though whitefish are not the most significant source of radionuclides for the local populations.[12]

Valuable Fish Species

Valuable fish species include the anadromous chinook, sockeye and coho salmon, steelhead trout, and American chad; these species migrate through the Hanford reach on their way to and from spawning areas upstream. Resident species, such as bass, other spiny-ray fish, catfish, whitefish, trout and sturgeon are locally important game fish.

Anadromous Fish

The fish species of greatest importance in the Hanford reach of the Columbia River are the salmon and steelhead. These species spend most of their life in the ocean and are in fresh water during their early life stages and as adults returning to the river to spawn.

The yearly number of adult anadromous fishes passing through the Hanford area is indicated by the adult fish passage counts made at Priest Rapids Dam, the dam immediately upstream (Table 035(2b)-4). Adult salmonid movement through the Hanford section of the river occurs during all months of the year, but greatest numbers pass during the spring to early fall period. Peak adult migration periods are generally as follows:

1. Sockeye - July-August
2. Chinook - April-May, August-September
3. Coho - September-October
4. Steelhead - August-October

Routes of migration through the area are generally along the left shore (the shore opposite Hanford No. 2 site).[13] The left shore fish ladders of the dams downstream from Hanford consistently pass more fish than the right shore ladders.[14]

The section of the Columbia River from Ringold to Priest Rapids is unique in that it is a section of the main stem Columbia River used for spawning by the fall run of chinook salmon. Other major main stem spawning areas, both upstream and downstream, are not considered suitable spawning areas due to impoundments by the river dams. This last free-flowing stretch of the river has had a marked increase in utilization by spawning

TABLE 035(2b)-4

Adult Anadromous Fish Passage at Priest Rapids Dam and Estimated Chinook Salmon Spawning Near Hanford
1966-1970

Species	1966	1967	1968	1969	1970
Chinook salmon *	66,915	48,918	48,314	40,786	43,934
Sockeye salmon *	170,071	123,786	108,308	39,240	77,422
Coho salmon *	11,903	8,879	13,212	1,351	4,971
Steelhead trout *	13,006	7,354	10,524	6,650	5,442
American shad *	716	239	300	3,440	7,163
Fall chinook ** spawning near Hanford	21,707	22,869	24,920	31,556	26,775

* Priest Rapids Fish Passage Reports, Grant Co. PUD, Ephrata, Wash.

** Based on a conversion factor of 7 fish/redd.

salmon, presumably, partly as the result of upstream displacement of populations that formerly spawned in the Columbia downstream from Richland.[15]

Estimates of the number of chinook salmon that spawn in the Hanford reach of the Columbia River have been made annually, by aerial survey, since 1947. In recent years, the locally spawning population has ranged from approximately 22,000 to 32,000 fish (Table 035(2b)-4). This is about 18% of the fall chinook spawning escapement to the river, and nearly 40% of the fall run passing McNary Dam (River Mile 292).[16] An estimated 10,000 steelhead trout also spawn in the Columbia River near Hanford.

The principal salmon spawning areas upstream from the Site of Hanford No. 2 are the Columbia River tributaries and fish hatcheries. About 40% of the total adult fall chinook escapement to the Columbia River either passes through or spawns in the Hanford reach of the river.

Young salmon hatch during mid to late winter and emerge from the gravel in February and March. The timing and numbers of young salmon and steelhead passing the upstream Priest Rapids Dam during 1965-1967 are shown in Table 035(2b)-5. Practically all of the young sockeye salmon are over one year of age when they pass to the ocean. From 10 to 15 percent of the chinook outmigration are fish one year and older and they pass Priest Rapids Dam in May. The remainder of the young chinook are less than one year of age (zero-age class). From 40 to 60 percent of the chinook juveniles migrated past Priest Rapids Dam in

TABLE 035(2b)-5

Timing and Estimated Numbers of Juvenile Salmonids Passing Priest Rapids Dam, 1965-1967 (Reference 16)

Year	Sockeye		Chinook		Coho		Steelhead	
	Timing	Est. numbers (millions)	Timing	Est. numbers (millions)	Timing	Est. numbers (millions)	Timing	Est. numbers (millions)
1965	Early May	2.63	Early Aug.	1.62	Mid May	0.22	Mid May	0.27
1966	Early May	4.10	Early Aug.	1.35	Mid May	1.17	Mid May	0.24
1967	Early May	0.95	Early Aug.	2.07	Mid May	1.17	Mid May	0.26

August during 1965-1967, an indication that the outmigration of the salmon produced in areas upstream from Hanford is delayed, presumably due to the creation of the reservoir complex upstream.[17] The chinook produced in the Hanford reach move out of the area during mid-April to mid-June, the normal time of emigration.

Special study of the local sport fishery conducted for a year in 1966-1967[18] gave an estimated annual catch of approximately 3000 fish in the section of the Columbia from Richland (River Mile 339) to Ringold (River Mile 354). Since the time of this survey, sport fishing intensity, particularly from boats, has probably increased, which would tend to make the present annual catch higher.

Project Effects

The projected impact of thermal discharges from Hanford No. 2 on important species is discussed below. The projected radiological impact is discussed in Section 015(4). Both effects are expected to be insignificant.

Recommended "optimum" temperature ranges for several salmonid life activities are as follows:[19]

Migration	7.2 to 15.5°C	(45-60°F)
Spawning:	7.2 to 12.8°C	(45-55°F)
Rearing:	10 to 15.5°C	(50-60°F)

The Columbia River temperatures in the Hanford reach are usually well below the optimum maximum rearing and migration temperatures from March through June. The addition of small amounts of heat during this period is not expected to be detrimental and may be of benefit during the spring months when river temperatures are near the lower optimum limit.

The period from July through October is the time when addition of heat to the river is of greatest significance. Maximum River temperatures may reach 21°C (70°F) during this time, and the minimum temperatures are usually above the optimum for salmonids. During the warm summer months the Columbia River is a marginal habitat for salmonids with respect to temperature, and the addition of substantial amounts of heat to the river at this time would not be beneficial.

The maximum rate of blowdown from Hanford No. 2 to the Columbia River will be 6500 gpm (14.5 cfs), which is 0.047% of the minimum flow (36,000 cfs) of the river as regulated by Priest Rapids Dam, or about 0.01% of the annual mean river flow (115,000 cfs). The temperature of the blowdown during the warm period of the year may be about 30°F warmer than the river temperature. Provision will be made for rapid mixing of blowdown water with the river. Addition of blowdown during periods of minimum river temperature will raise river temperatures only 0.01°F.

The expected heat introduction by the blowdown is an order of magnitude less than that formerly discharged to the river in the plutonium production reactor effluents.[20] It is doubtful that the heat added by the plutonium reactors was beneficial to the salmon in the area; on the other hand, it certainly did not destroy the section of the river below the reactor effluent outfalls as suitable habitat for these fish, and it had no observable effect on the upstream movement of salmonids.[13] It is concluded that the thermal addition to the Columbia River from Hanford No. 2 will have no measurable effect on the salmon in view of its small quantity and thorough mixing with the river water.

Warm water species such as catfish and spiney rays would benefit from any increase in river water temperature. These species prefer temperatures higher than those prevailing in the Columbia River during much of the year. Small mouth bass, for instance, do not spawn until water temperatures are about 12°C (54°F) or above.

Planktonic Forms and Fish Larvae

The plankton of the Hanford reach of the Columbia River is dominantly phytoplankton and is derived to a large extent from areas upstream, although some local sloughing-off of periphyton contributes to the total plankton of the area.[21] The amounts of plankton in the river vary seasonally from less than 0.1 grams dry weight per cubic meter during November through January to a maximum of two grams dry weight per cubic meter in May.[22] Total daily plankton transport ranges from 3×10^3 kilograms (3.3 tons) to 400×10^3 kilograms (440 tons).

The maximum water intake of Hanford No. 2 from the Columbia River is approximately 56 cfs (25,000 gpm), or about 0.16 percent of the minimum licensed release rate of 36,000 cubic feet per second at Priest Rapids Dam, or 0.05 percent of the mean annual flow (115,000 cfs) of the Columbia in the vicinity of the reactor. The plankton withdrawn with the makeup water will be lost to the river. This is expected to have an imperceptible effect upon the river ecology because 1) the amount of plankton withdrawn is only a small fraction of the total amount in the river, and 2) the phytoplankton is of minor importance as a direct food source for important fish species.[23]

Over 95 percent of the diet of juvenile chinook salmon in this section of the Columbia River is composed of various forms of insects, dominantly immature midges (Tendipedidae).[24] The fraction of immature aquatic stages of these insects entrained in the cooling water will be limited by the large area filtration system in the water intake system.

Larval forms of salmonids and other important fish species will be restricted from the cooling water by the intake filtration. The larval forms of some coarse fish may be small enough to penetrate the filters. The numbers that will be destroyed will be extremely small compared to the total population in the river.

Effects of Withdrawal and Return of Cooling Water

Provision is being made to take cooling tower makeup water from the Columbia River at rates up to 25,000 gpm. Since this water will be withdrawn from the river with a superficial velocity no greater than 0.02 fps through the infiltration system (refer to Section 025(2b), no scouring effects will be encountered.

Excess makeup water (blowdown) beyond that needed because of evaporation will be returned to the river. As discussed in Section 025(2e), this water will contain inorganic salts and trace amounts of chlorine, but the organic content of the water will be very low. Furthermore, the water will have been aerated in the cooling towers. The biological oxygen demand of this returning water will not adversely affect the water quality of the river.

Adequacy of Ecological Studies

There are several areas within the Hanford Reservation upon which the Atomic Energy Commission, through its contractor Battelle-Northwest, is conducting bio-environmental research programs in terrestrial and aquatic ecology. The abundance and distribution of wildlife, fish and other aquatic species have been documented over many years of Hanford operation. Study areas under the "Arid Lands Ecology" program are both in the immediate vicinity of the Hanford No. 2 Site, and at sufficient distance from the Site to remain uninfluenced by the operation of the proposed plant.

Ecological studies on the Hanford Reservation have been in progress for the past 25 years because of the plutonium production and radioactive waste processing activities on the Reservation. It is probable that all or portions of such studies will continue because of operation of the N-Reactor serving Hanford No. 1, operation of the fast test reactor which is part of the FFTF complex, and continued operation of chemical separations and waste management facilities--in addition to the operation of Hanford No. 2. It is believed that the environmental monitoring program described in Section 015(4) will be sufficient to identify any contribution by Hanford No. 2 to ecological changes observed on the Hanford Reservation.

(2) Fish and Wildlife.

(c) Agree to provide replacement and/or compensation for any wildlife, fish and other aquatic life and eco-system damage or loss caused by project construction and operation.

The Supply System will cooperate fully with State Agencies having jurisdiction to determine whether operation of the project damages any wildlife, fish or other aquatic species or produces any eco-system loss or damage. The Supply System will agree to take appropriate measures to provide replacement or compensation for damage or loss if mutual agreement as to the extent of any such damage is reached through consultation with the appropriate State Agency and the Council.

WAC 463-12-035(2)(c) - QUALITY OF THE ENVIRONMENT - NATURAL RESOURCES (Supp. filing 7/1/71)

Representatives of the Council and the Applicant have jointly prepared, and the Applicant hereby adopts, the following statement as to the Applicant's responsibility for litigation of damage or loss caused by the Project.

> The Applicant agrees to negotiate in good faith with the State agency involved in the determination of the extent of damages or the replacement or compensation required, and in the event the parties are not able to mutually agree as to the action to be taken by the Applicant, then, in that event, the matter shall be submitted to arbitration as provided by Section 7.04 of the laws of the State of Washington.

(2) Fish and Wildlife.

(d) Provide for post-operational studies that will monitor the effect of the project on wildlife, fish, and other aquatic life, and the ecology of the area environs and agree to provide appropriate additional protective measures if such measures are deemed necessary by the Council.

The Supply System will conduct post-operational studies to monitor any effect of the project on wildlife, fish, and other aquatic life, and the ecology of the area. Such studies will be conducted in conjunction with the appropriate portions of the environmental quality surveillance program described in Section 035(lb).

The Supply System will initiate appropriate steps to correct any adverse effects attributable to the operation of the plant as evidenced by the environmental surveillance programs.

Environmental Radiological Monitoring Program

The radiological monitoring program described in Section 015(4) Health and Safety will include annual collection and analysis of aquatic and terrestrial biota. The method and frequency of collection and sampling and procedures for analysis are discussed in Section 015(4).

The Supply System fish and wildlife survey and surveillance program will build upon the surveillance work of other agencies doing parallel or complementary work. A review to determine any effect of project operation on fish and wildlife indigeneous to the Project site will be made and reported upon as required.

Columbia River Fisheries represent the most important species population in the Hanford No. 2 area although the environmental program will survey terrestrial species as discussed in Sections 015(4) and 035(1)(b).

A separate evaluation of the Hanford No. 2 effect on fisheries is contained in Section 015(4) pages 15 and 16.

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Section 040

Aesthetics

WAC 463-12-040 - QUALITY OF THE ENVIRONMENT - AESTHETICS

(1) Provide plans to show that the thermal power plant and appurtenant facilities are located and designed to insure that insofar as is practicable the physical appearance of the installation will be aesthetically compatible with the surroundings.

The proposed Site is located in an area which is sparsely populated and relatively isolated from main traffic patterns. The Site is within the U. S. Atomic Energy Commission's Reservation and is now restricted to the general public by reasons of national security.

The Supply System will construct a Project which is functional, efficient and in keeping with standards of public utility practices.

Landscaping, visitor reception areas and vistas and buildings will be aesthetically compatible with the surroundings and in harmony with the Supply System's Hanford No. 1 facility as shown in the following photographs.

Aesthetics

The AEC Hanford Reservation on which Hanford No. 2 is located is arid and desert-like with sagebrush being the most prominent vegetative covering.

The general character of the environment on and adjacent to the Site is shown by the attached photograph entitled "Aerial closeup of Hanford No. 2 looking Southwest." The AEC-owned railroad which crosses the Site can be seen in the foreground and the four-lane highway between Hanford No. 2 and the FFTF facility is barely visible near the top of the photo.

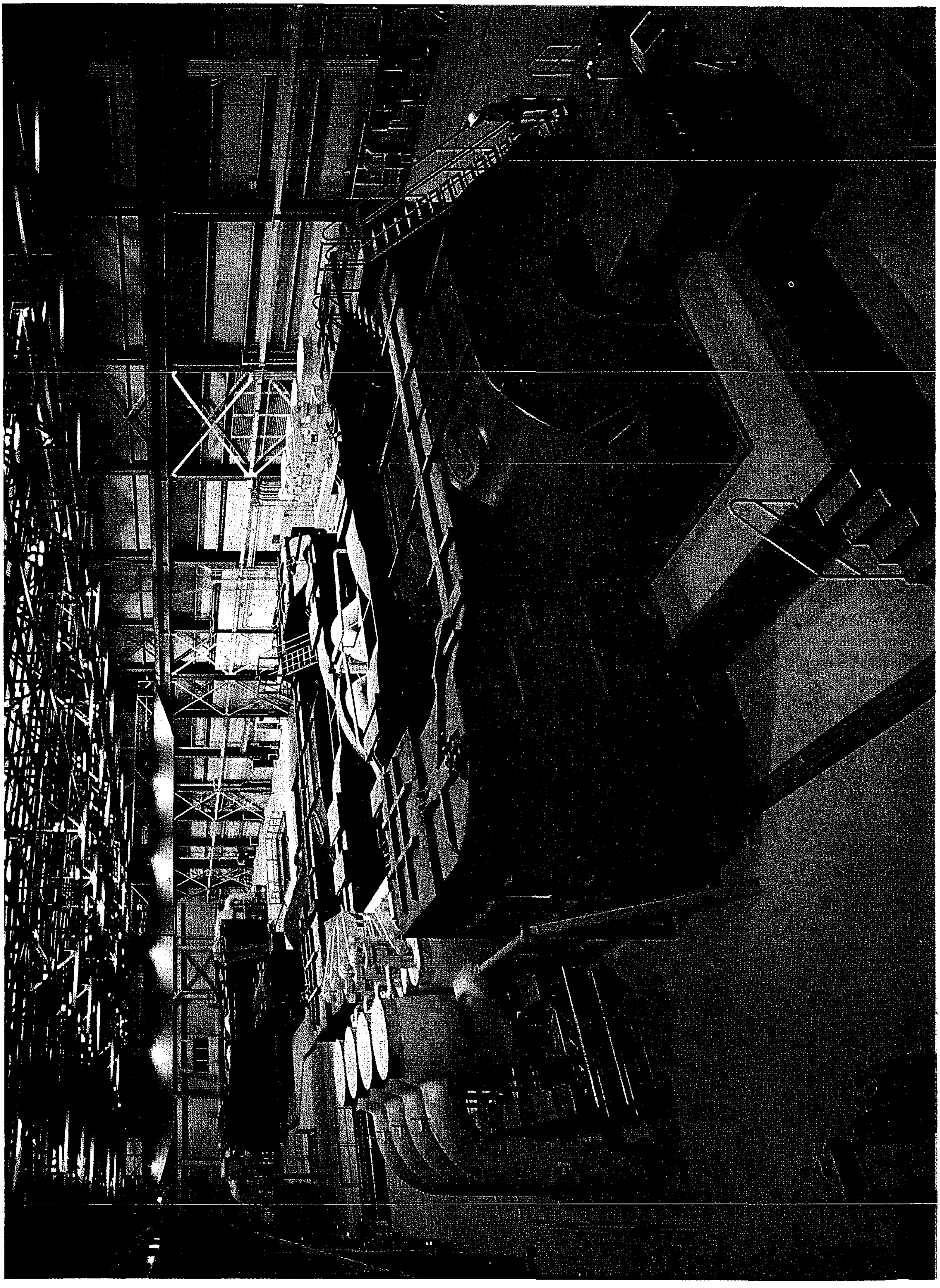
Figure 040-1 is a preliminary sketch of the principal buildings for Hanford No. 2. The tall building shown in the center of Figure 040-1 is the 232-foot high reactor building. The turbine-generator building, on the right, is about 140 feet high. The low building on the left contains the reactor control console, process computer, critical switchgear, heating and ventilation equipment and facilities for processing radioactive liquids and gases. All of these buildings will be constructed and colored to be consistent with the aesthetic standards previously established by the Supply System during construction of Hanford No. 1.

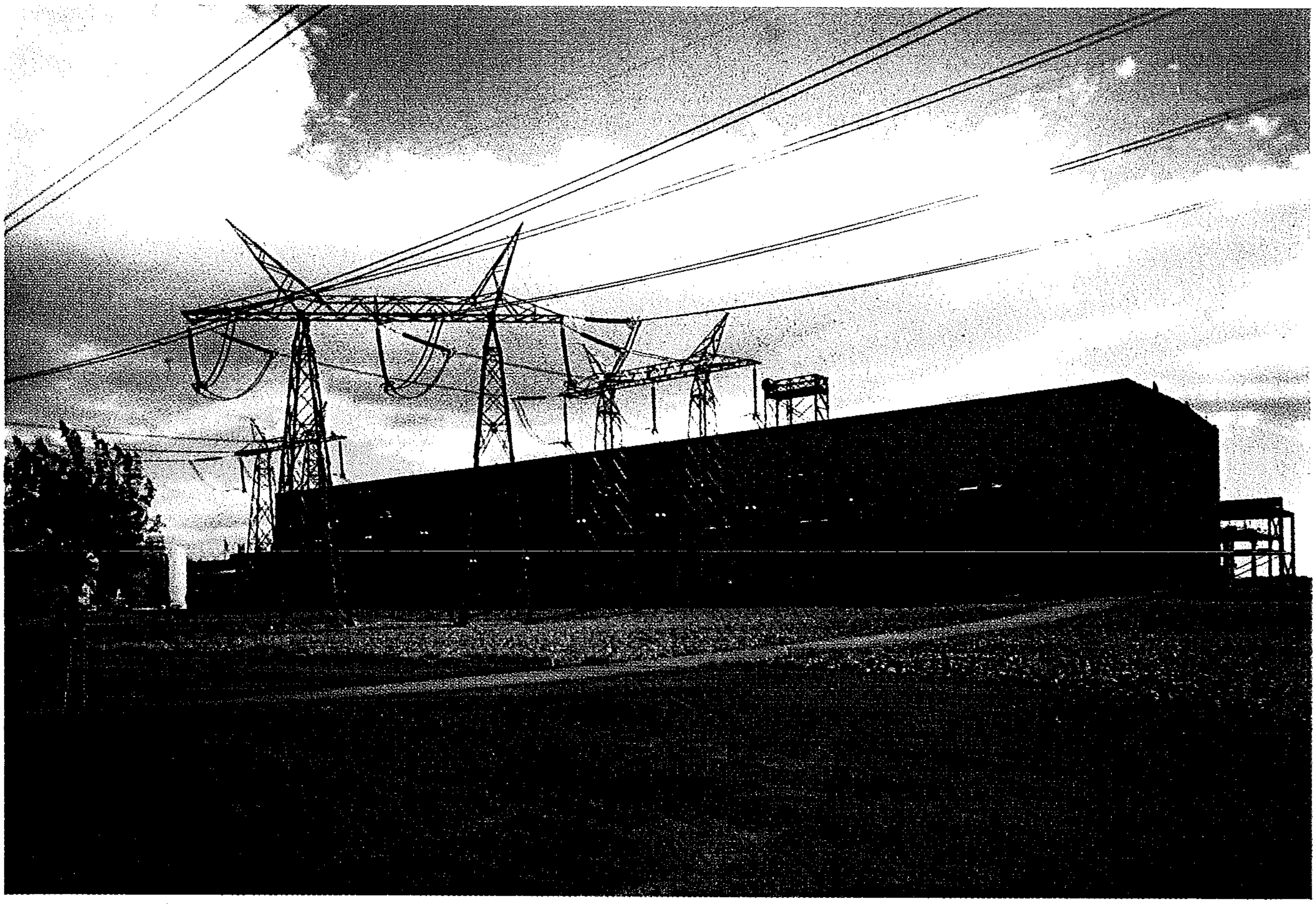
The cooling tower system will be illustrated in an artist's rendition to be filed in September 1971. The cooling tower system will be located immediately adjacent to the plant.

Landscaping, like the buildings, will serve both a functional and an aesthetic purpose. Suitable grasses, trees and hedges will be planted where required to control grass fires and erosion and where appropriate to the enhancement of the outward appearance of the Project.

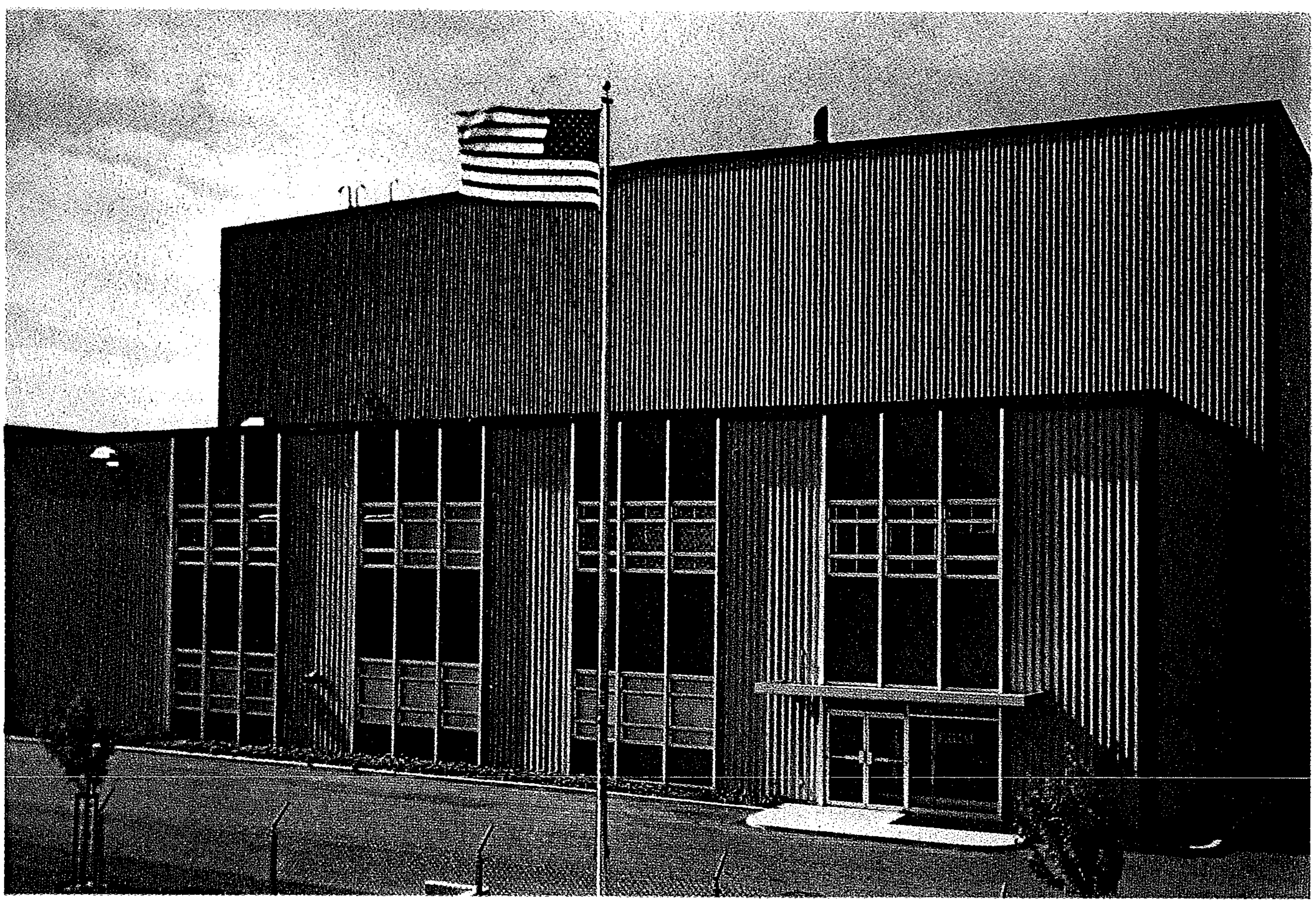
Other vegetation within the Site area, disturbed or destroyed as a result of construction, will be replaced with indigenous species so as to return the ground cover to its natural state.

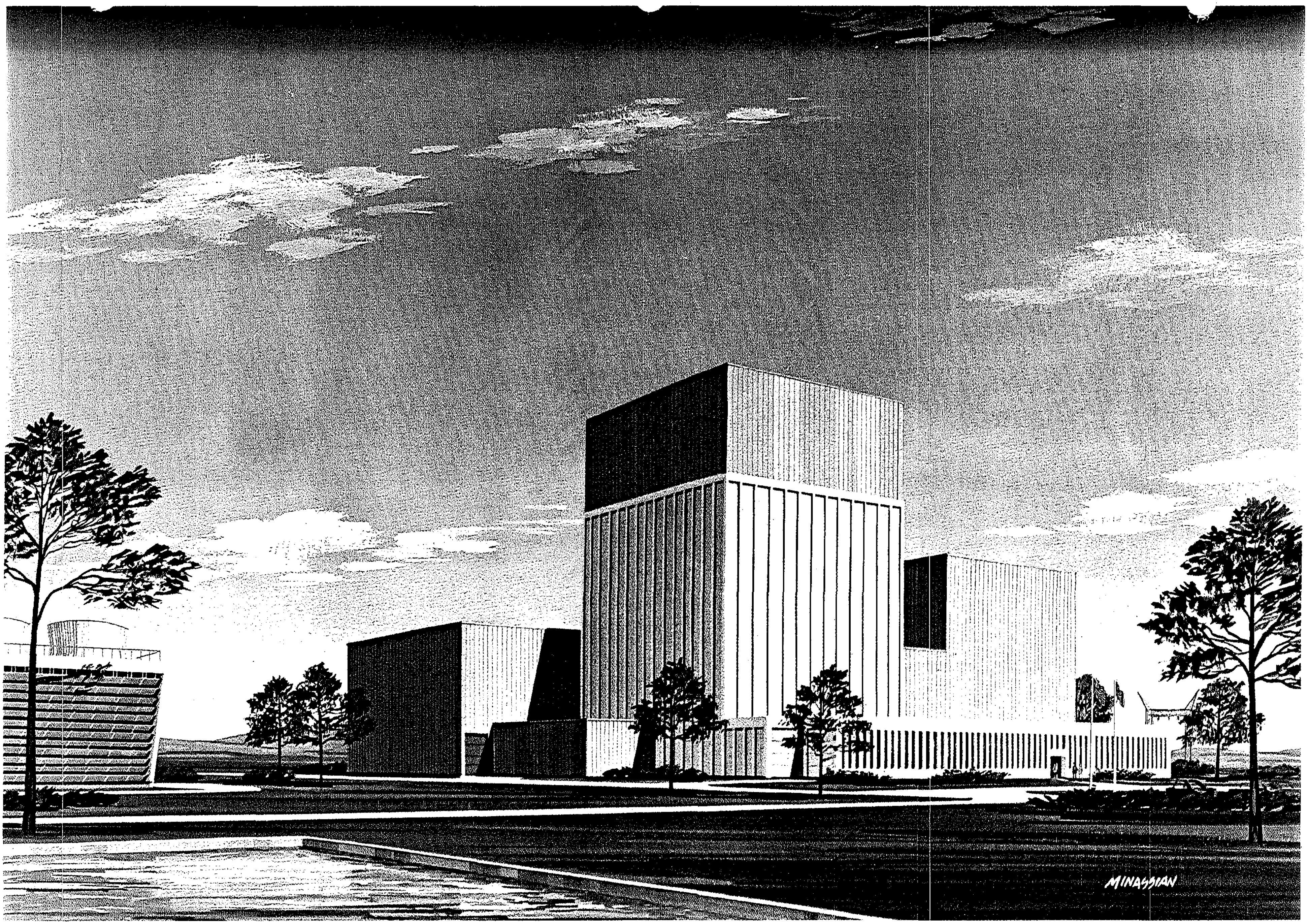
It is the intent of the Supply System to construct a facility not only practical from a functional point of view, but one that is architecturally appealing.





Views of Hanford Number One, currently the only nuclear steam electric generating station in the Pacific Northwest, showing transformer bays against turbine-generator building (above) and main entrance to plant.





ARTIST CONCEPT OF WASHINGTON PUBLIC POWER SUPPLY SYSTEM
1100 MEGAWATT NUCLEAR POWER PLANT, HANFORD NO. 2

10/12/71

Section 045

Recreation

The present recreational opportunities in this region consist of boating, water skiing, swimming, fishing, and picnicking. The area also has a number of parks which are provided by the Corps of Engineers, the Benton County Park and Recreation Department and the Park and Recreation Departments of the cities of Pasco, Richland and Kennewick. These facilities are in close proximity to the desert environs of the Hanford Reservation.

Benton County Park properties encompass more than two thousand acres. In addition the City of Richland has more than 800 acres reserved for park usage and much of the acreage in the County and City borders the Columbia River. Columbia Park alone provides more than 4.5 miles of river shoreline, and includes boat docks water ski ramps, skiing beaches, archery range, golf course, swimming and picnic facilities, tennis courts, ball fields, basketball standards and playgrounds.

Much of the recreation lands available in Benton County are undeveloped, however, the land is available and could be used for recreational purposes if a need existed.

Recently the AEC opened the Columbia River to the public from the 300 area north of Richland to the old town of Hanford on the Hanford Reservation, a distance of 17.5 miles. This is an uncharted stretch of river containing many shallows, sandbars and submerged rocks, and is generally hazardous to navigation. To date boat traffic in the area is very light and is expected to remain at such level until the channels are clearly marked for navigation, which is not expected to be accomplished in the near future.

For security and safety reasons public access to the AEC's side of the Columbia River shoreline is limited to the high water mark. The Hanford No. 2 Site lies within this newly opened river area.

At this time access by land from Richland to the Project Site is over an AEC road and travel is restricted to the general public unless badged by the Supply System, the AEC or one of it's contractors.

However, the Supply System will provide a fully equipped air-conditioned visitor information center in the Hanford No. 2 facility to accommodate those who wish to visit the project. This center will be used to inform the public on nuclear power, energy requirements, safety, environmental cleanliness and aesthetic qualities inherent in a generating plant using the power of the atom. Appropriate exhibits will show the growing requirement for electricity, nuclear power and safety, radiation, the boiling water reactor, resource conservation, plant model and a schematic representation of how the plant operates. This facility will be available to the general public on a scheduled basis throughout the week.

The visitor center will be located in the Plant's Administration Building and will accommodate 200 people. In addition, a viewing area enabling visitors to look into the Control Room is being incorporated in the plant design. To meet the needs of visitors to the information center who may wish to picnic, the Supply System will provide picnic tables and restroom facilities within the landscaped grounds of the central plant area.

It is our opinion that the desert quality of the land, with the wind, dust and high daytime temperature along with the lack of shade, and the general monotony of the surrounding area does not make the site an attractive area for recreational purposes.

It does not appear that the pressures by the public on existing recreational areas and facilities within Benton County including the City of Richland warrant the construction of additional outdoor facilities at Hanford Number Two at this time.

However, if this picture should change, and it can be substantiated that recreational pressures on existing areas warrant the establishment of an outdoor recreational facility at Hanford Number Two the Supply System will cooperate to the fullest extent with State and County agencies to develop a facility which is mutually satisfactory to all parties.

Section 050

Economic Finances

WAC 463-12-050 -- ECONOMICS -- FINANCES

(1) File an economic feasibility study on the proposed project setting forth:

(a) The estimated investment in the site, thermal power plant and related properties and facilities.

The "Summary Engineering Report, Washington Public Power Supply System Nuclear Project No. 2" prepared by R. W. Beck & Associates is included in Exhibit 4.

The estimated investments in the site, thermal power plant and related properties and facilities are as follows:

1.	Investment in the site	* None
2.	Estimated thermal power plant related properties and facilities	$227,433,000
3.	Escalation	40,723,000
4.	Contingencies	19,743,000
5.	Total	$287,899,000

*The Supply System will lease the land required for the site from the U. S. Atomic Energy Commission for an agreed annual payment for a 99 year term. Arrangements with the AEC will include any necessary easement for transmission right-of-way to connect with the BPA grid.

Under the arrangements described above, no significant land purchase would be required and lease payment would be treated as annual operating cost as a cost of the Project output.

<u>*WAC 463-12-050*</u> *-- ECONOMICS -- FINANCES*

(1) File an economic feasibility study on the proposed project setting forth:

(b) The source and amount of funds to finance the entire project.

Short term notes in the amount of $15 million issued in February 1971 will cover initial expenses of engineering and other professional services, site studies, surveys, obtaining permits, licenses and approvals, and preparing detailed plans and specifications. These notes will be retired from the proceeds of revenue bonds to be issued prior to commencement of construction.

Approximately $384,900,000 of Revenue Bonds will be issued to finance costs of construction of the Project and retire the interim financing notes.

The total amount of the issue will be dependent upon the net interest rate of the tax exempt bonds as well as detailed cost estimates to be prepared subsequent to award of contracts for the major components and detailed design of the total project. The present estimate of the permanent financing based upon 6% interest rate is as follows:

Total Construction Cost (Section 050 (1a))	$287,899,000
Initial Core	34,000,000
Net Interest During Construction	52,393,000
Financing and Other Costs	10,608,000
Total Bond Issue	$384,900,000

An additional contingency fund of approximately $25,547,000 will be established from advances by project participants to establish a reserve fund for contingencies, working capital and debt service.

(1) File an economic feasibility study on the proposed project setting forth:

(c) The proposed rate structure and type and number of power purchasers.

A total of 94 public agencies referred to herein as Participants, including 22 public utility districts, 27 municipalities and 45 electrical cooperatives will pay all annual costs of the Project, including operating cost and debt service cost. Annual costs are defined in Section 050(1d).

Each Participant will receive credit for an equivalent percentage of the electrical output of the Project and this output will be purchased from the Participants by the Bonneville Power Administration, according to the terms of "Net Billing Agreements" with the Bonneville Power Administration.

The types and numbers of power purchasers, and details of financing and rate structure, are described in the "Official Statement", identified as Exhibit 4, attached hereto.

(1) File an economic feasibility study on the proposed project setting forth:

(d) A pro forma statement of revenue and expenses. The estimated investment and/or annual expenses to satisfy the requirements for quality of the environment shall be separately stated in the study.

Each of the 94 Participants has executed a Net Billing Agreement with the Supply System and BPA wherein each Participant assigns his share of the Project output to BPA and the output is added and pooled with other power sources available to BPA. Under these arrangements, the cost of the power produced by the Project is borne by all Bonneville customers. One of the conditions under which Congress has authorized BPA to enter into these net billing contracts is that "any costs or losses to Bonneville under these arrangements will be borne by all Bonneville rate customers through rate adjustments, if necessary".

Revenue

Each Participant is obligated to pay the Supply System its fractional share of the Supply System's expenses incurred in connection with this Project on a monthly basis each year. A list of the Participants and each Participant's fractional share of the Project output and the fractional share of the annual Project cost to be paid to the Supply System by the Participant is included in Exhibit 4 "Official Statement" attached.

The Participant's obligation to pay the corresponding fractional share of the annual cost is independent of whether the Project is completed, operable or operating.

The Supply System will each year prepare an annual budget which shall be the basis for billing to each of the Participants for their fractional share. The annual budget will provide for all Project costs including accrual and amortization resulting from the ownership, operation and maintenance of the Project as well as repairs, renewals, replacements or additions to the Project.

The "Summary Engineering Report, Washington Public Power Supply System Nuclear Project No. 2" contained in the "Official Statement", Exhibit 4, sets forth the elements which make up the basis for each item of annual cost. The annual budget for each year will contain a detailed breakdown of the following general categories.

<u>Fixed Annual Costs</u>

- Debt Service Costs
- Insurance
- Replacements
- Operating Costs
- Maintenance Costs
- Administrative and General Costs
- Transmission Costs
- Fixed Charges on Fuel Inventory
- Less Interest Earnings
  - Subtotal

<u>Variable Production Cost</u>

- Variable Fuel (Burnup) Cost
- Variable O&M Cost
  - Subtotal

<u>Total Annual Costs</u>

The "Official Statement" also contains copies of the Project Agreement between Bonneville Power Administration and the Washington Public Power Supply System as well as a copy of the Net Billing Agreement between BPA, the Supply System and each Participant. These agreements require preparation of an annual budget and a quarterly report.

The Supply System will submit to the Thermal Power Plant Site Evaluation Council a preliminary pro forma statement of estimated annual expenses separately stating those expenses necessary to satisfy the requirements for quality of the environment not later than July 1, 1971.

More than 11 percent of Hanford No. 2 direct construction costs is attributable to equipment, monitoring, recycle systems and aesthetics designed to insure that the quality of the environment is maintained. As shown in the itemized list below, more than $20 million has been allocated for environmental features:

Additional Radwaste Facilities	$ 5,500,000
Off-Stream Cooling System	14,306,000
Environmental Monitoring	150,000
Architectural Features	200,000
Landscaping	400,000
Total	$20,556,000

The above amounts do not represent the total cost of each facility but only the incremental portion chargeable to special features for protection of the environment as estimated by the Applicant's Architect-Engineer Burns and Roe, Inc.

The environmental features associated with Hanford No. 2 will result in a net annual cost per kilowatt hour of 5.27 mills, versus 4.75 mills if no environmental features were added.

By providing these environmental features and systems the Project's generating capability will be reduced from 1,130,000 kilowatts to 1,100,000 kilowatts. Further, net estimated annual costs including adoption of systems to maintain the quality of the environment will amount to $43,152,000, or an addition of more than $3.1 million in costs if no provision had been made for protection of the environment.

For illustrative purposes, Tables 050.1-1 through 4 give a breakdown of estimated preliminary capital costs, and annual costs resulting from the addition of environmental protective measures to the Project.

TABLE 050.1-1

Breakdown of Preliminary Capital Cost Estimate

	Environmental Features ($1000)		Balance of Plant ($1000)	Total (2) ($1000)
Direct Construction Cost	20,556	(1)	183,052	203,608
Contingencies and Escalation	6,085		54,381	60,466
Engineering and Const.Mgmt.	1,609		14,391	16,000
Owners Direct Cost	786		7,039	7,825
Sub Total	29,036		258,863	287,899
Other Costs	91		889	980
Initial Fuel	0		34,000	34,000
Int. During Const.	10,444		93,533	103,977
Financial, Legal and Misc. Costs Including Bond Discount	971		8,657	9,628
Gross	40,542		395,942	436,484
Estimated Income from Reserve	(5,186)		(46,398)	(51,584)
	35,356		349,544	384,900

(1) See Table 050.1-4 for breakdown of these costs
(2) Refer to Capital Cost Estimate @ 6% interest rate in Official Statement dated January 1, 1971, page 29

More than 11 percent of Hanford No. 2 direct construction costs is attributable to equipment, monitoring, recycle systems and aesthetics designed to insure that the quality of the environment is maintained. As shown in the itemized list below, more than $22 million has been allocated for environmental features:

Additional Radwaste Facilities	$ 5,500,000
Off-Stream Cooling System	16,620,000
Environmental Monitoring	150,000
Architectural Features	200,000
Landscaping	400,000
Total	$22,870,000

The above amounts do not represent the total cost of each facility but only the incremental portion chargeable to special features for protection of the environment as estimated by the Applicant's Architect-Engineer Burns and Roe, Inc.

The environmental features associated with Hanford No. 2 will result in a net annual cost per kilowatt hour of 5.27 mills, versus 4.71 mills if no environmental features were added.

By providing these environmental features and systems the Project's generating capability will be reduced from 1,130,000 kilowatts to 1,100,000 kilowatts. Further, net estimated annual costs including adoption of systems to maintain the quality of the environment will amount to $43,152,000, or an addition of more than $3.5 million in costs if no provision had been made for protection of the environment.

For illustrative purposes, Tables 050.1-1 through 4 give a breakdown of estimated preliminary capital costs, and annual costs resulting from the addition of environmental protective measures to the Project.

TABLE 050.1-1

Breakdown of Preliminary Capital Cost Estimate

	Environmental Features ($1000)		Balance of Plant ($1000)	Total (2) ($1000)
Direct Construction Cost	22,870	(1)	180,738	203,608
Contingencies and Escalation	6,770		53,696	60,466
Engineering and Const.Mgmt.	1,790		14,210	16,000
Owners Direct Cost	875		6,950	7,825
Sub Total	32,305		255,594	287,899
Other Costs	101		879	980
Initial Fuel	0		34,000	34,000
Int. During Const.	11,620		92,357	103,977
Financial, Legal and Misc. Costs Including Bond Discount	1,080		8,548	9,628
Gross	45,106		391,378	436,484
Estimated Income from Reserve	(5,770)		(45,814)	(51,584)
	39,336		345,564	384,900

(1) See Table 050.1-4 for breakdown of these costs
(2) Refer to Capital Cost Estimate @ 6% interest rate in Official Statement dated January 1, 1971, page 29

TABLE 050.1-2

Breakdown of Estimated Annual Costs

	Environmental Features ($1000)	Balance of Plant ($1000)	Total (1) ($1000)
FIXED COSTS			
Interest and Amortization	2,669	23,879	26,548
Payments to Reserve Fund	268	2,387	2,655
Insurance	0		1,630
O. and M. (Fixed)	316	2,828	3,144
Administration	122	1,104	1,226
Sub Total	3,375	31,828	35,203
Deduct			
Surplus Payment to Reserve	(145)	(1,310)	(1,455)
Total Fixed Costs	3,230	30,518	33,748
VARIABLE COSTS			
Fuel	0	10,020	10,020
O. and M. (Variable)	74	663	737
Total Variable Costs	74	10,683	10,757
TOTAL ANNUAL COSTS	3,304	41,201	44,505
Interest Earnings	(136)	(1,217)	(1,353)
NET ANNUAL COSTS	3,168	39,984	43,152

(1) Refer to Average Annual Cost Estimate @ 6% interest rate in Official Statement dated January 1, 1971, page 31

TABLE 050.1-3

Net Annual Cost Per Net Kilowatt-Hour

a. Number of hours/year - 8760 hrs.

b. Capacity Factor - 85%

c. Annual Operation - 7446 hrs.

d. Net Annual Costs
   1. With Environmental Features - $43,152,000
   2. Without Environmental Features - $39,984,000

e. Generating Capability
   1. With Environmental Features - 1,100,000 kw (1)
   2. Without Environmental Features - 1,130,000 kw (2)

f. Net Annual Cost Per Net Kilowatt-Hour (Levelized)
   1. With Environmental Features - 5.27 mills
   2. Without Environmental Features - 4.75 mills

(1) Net Capacity based on annual average backpressure of 2-1/2" Hg. assuming an average annual wet bulb temperature of 45°F.

(2) Net Capacity based on annual average backpressure of 2" Hg. assuming an average annual river water temperature of 52°F. Also includes increase in capacity due to 15 Mw decrease in auxiliary power requirements.

TABLE 050.1-4

Direct Construction Costs Attibutable to

Expenses Necessary to Satisfy the Requirements for the

Quality of the Environment

Additional Radwaste Facilities		
Liquid Radwaste Equipment	$ 1,000,000	
Gaseous and Solid Radwaste Equipment	2,000,000	
Radwaste Building Costs	2,500,000	
		$ 5,500,000
Off-Stream Cooling System (1)		
Cooling Towers	$ 5,856,000	
Cooling Tower Electric	720,000	
Circulating Water Piping Increase	1,500,000	
Circulating Water Pumps & Motor Increase	580,000	
Makeup Pump House	2,255,000	
Makeup Water Piping	2,500,000	
Blowdown Water Piping	165,000	
Makeup Pump House Electric	730,000	
		$14,306,000
Environmental Monitoring		150,000
Architectural Features		200,000
Landscaping		400,000
		$20,556,000

(1) Differential cost between closed cycle cooling tower system and direct river water system.

TABLE 050.1-2

Breakdown of Estimated Annual Costs

	Environmental Features ($1000)	Balance of Plant ($1000)	Total (1) ($1000)
FIXED COSTS			
Interest and Amortization	2,970	23,578	26,548
Payments to Reserve Fund	298	2,357	2,655
Insurance	0	1,630	1,630
O. and M. (Fixed)	352	2,792	3,144
Administration	136	1,090	1,226
Sub Total	3,756	31,447	35,203
Deduct			
Surplus Payment to Reserve	(161)	(1,294)	(1,455)
Total Fixed Costs	3,595	30,153	33,748
VARIABLE COSTS			
Fuel	0	10,020	10,020
O. and M. (Variable)	82	655	737
Total Variable Costs	82	10,675	10,757
TOTAL ANNUAL COSTS	3,677	40,828	44,505
Interest Earnings	(151)	(1,202)	(1,353)
NET ANNUAL COSTS	3,526	39,626	43,152

(1) Refer to Average Annual Cost Estimate @ 6% interest rate in Official Statement dated January 1, 1971, page 31

TABLE 050.1-3

Net Annual Cost Per Net Kilowatt-Hour

a. Number of hours/year - 8760 hrs.

b. Capacity Factor - 85%

c. Annual Operation - 7446 hrs.

d. Net Annual Costs
   1. With Environmental Features - $43,152,000
   2. Without Environmental Features - $39,626,000

e. Generating Capability
   1. With Environmental Features - 1,100,000 kw (1)
   2. Without Environmental Features - 1,130,000 kw (2)

f. Net Annual Cost Per Net Kilowatt-Hour (Levelized)
   1. With Environmental Features - 5.27 mills
   2. Without Environmental Features - 4.71 mills

(1) Net Capacity based on annual average backpressure of 2-1/2" Hg. assuming an average annual wet bulb temperature of 45°F.

(2) Net Capacity based on annual average backpressure of 2" Hg. assuming an average annual river water temperature of 52°F. Also includes increase in capacity due to 15 Mw decrease in auxiliary power requirements.

TABLE 050.1-4

Direct Construction Costs Attributable to

Expenses Necessary to Satisfy the Requirements for the

Quality of the Environment

Additional Radwaste Facilities	$ 5,500,000	
Off-Stream Cooling System (1)	16,620,000	
Environmental Monitoring	150,000	
Architectural Features	200,000	
Landscaping	400,000	
Total	$22,870,000	(2)

(1) Differential cost between closed cycle cooling tower system and direct river water system
(2) Represents 11.2% of total Direct Construction Cost

Exhibits

EXHIBIT I

UNITED STATES
ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON 99352

Mr. Owen W. Hurd, Managing Director
Washington Public Power Supply System
P. O. Box 6510
Kennewick, Washington 99336

Dear Mr. Hurd:

Your letter of October 7, 1970, inquired into the possible arrangements which could be made to acquire a site on the Hanford Reservation for the construction and operation of a 1,100 MW nuclear generating station.

At the outset, we wish to confirm your understanding that the Atomic Energy Commission does have authority, subject to certain conditions, to sell or lease land. This authority is contained in Section 120 of the Atomic Energy Community Act of 1955, as amended, and Section 161g of the Atomic Energy Act of 1954, as amended. There is also general federal disposal authority available under the Federal Property and Administrative Services Act of 1949, as amended.

As was indicated at the briefing conference, our current thinking is that the land would be made available by lease under Section 120 of the Atomic Energy Community Act of 1955, as amended, which applies specifically to the Hanford site. Under Section 120 of the Atomic Energy Community Act, the Commission has authority to lease land upon a determination that such a disposition will serve to prevent or reduce the adverse economic impact of actual or anticipated reductions in the Commission's programs. Prior to making any disposition of property, the basis for the proposed disposition must be submitted to the Joint Committee on Atomic Energy. If the land were leased under the provisions of Section 120, it would be necessary for the Commission to receive the estimated fair rental value.

The Commission has no objection to the WPPSS employees and consultants entering upon land of the Hanford Works for the purposes of making surveys and investigations of specific plant sites. Access to the plant site can be handled in accordance with WPPSS existing badging procedures. A permit can be granted to WPPSS to cover any onsite work required in connection with such surveys and investigations.

As was pointed out at the briefing conference, it would not be appropriate for the Commission to take the initiative in selecting potential sites and assessing their suitability. Close location of the proposed nuclear reactors to AEC installations is a new consideration in our operations, but we are confident that the proposed studies to be undertaken by WPPSS will be expedited by the use of AEC data currently available to WPPSS and others. In this regard, you should maintain a close relationship with the AEC on the progress of your studies leading to the selection of the specific proposed site or sites, to avoid unexpected delays in AEC's determination of site compatibility. I believe you appreciate the desires of the AEC to both encourage the growth of the nuclear park at Richland and fulfill its responsibilities to properly manage the complex that has been established over these many years at Richland. Since any nuclear power plant located on the site would have to be compatible with the Atomic Energy Commission's operations, there might be additional expenses to WPPSS in addition to costs for rental of the land involved, resulting from the effects of such activities on adjoining AEC property. As examples, use of cooling ponds might affect the water table in portions of the site which could affect building foundations or waste disposal activities, or there might be expenses for any relocation of AEC facilities which would be necessary.

With regard to your request for information (nonclassified), we will be glad to continue our cooperation in furnishing such data. In this connection, Mr. L. F. Perkins of this office met with representatives of WPPSS and Burns & Roe and identified for them published reports generated at the Hanford Project relating to the characteristics of the plant site. A significant number of published documents were also made available at that time.

With a minimum of restrictions, easements for ingress and egress and other services can be made available as indicated below:

A. Roads

Generally speaking, easements can be granted for construction of roads to the WPPSS site from existing roads, either AEC or State Highway 240.

B. Railroads

The Hanford Project railroad ties in with the Milwaukee Railroad at the north end of the project and with the Burlington Northern and the Union Pacific on the south. An easement can be granted by AEC for WPPSS to build a connecting track from AEC's systems to the proposed plant site. However, as in the case of an easement for roads, the exact location of the easement must await a firm decision on the site selected.

C. Power Lines

It is suggested that WPPSS arrange with BPA to receive power over the "third leg" of the 230 KV BPA line from Midway Substation which is currently leased from BPA by Richland. This line enters the Hanford Project through Section 18, TWP 13N, Range 23E, runs east by southeast across the project and currently ties in with AEC 230 KV line in Section 28, TWP 13N, Range 27E. Arrangements can also be made for WPPSS to tie into the AEC power grid for construction and plant startup power providing it is understood that the 100-N-WPPSS, 100-KE Reactor, and the new WPPSS plant would never be started up at the same time or with an overlapping startup power.

D. Communication Lines

The AEC's project telephone system has been sold to General Telephone Company of the Northwest, Inc. and to United Telephone Company of the Northwest. At the time of sale, a number of easements were granted by AEC to the companies. There does not appear to be any reason why additional easements cannot be granted for communications lines when they are required.

Generally speaking, the above and other services required for plant operations which are not readily available commercially could be obtained from the AEC to the extent that the Commission has excess capability and continues to provide such services for its own operations. Charges for any services and utilities provided by the Commission will be in accordance with AEC's established pricing policy.

You understand that the above expression of AEC's willingness to consider the leasing of property at the Hanford site is not to be construed as any guarantee or assurance that a construction permit or operating license will be issued for a nuclear generating station on the Hanford site.

We would appreciate your continuing to keep this office advised of your activities.

Very truly yours,

D. G. Williams
Manager

EXHIBIT 2

ZONING

ORDINANCE

OF

BENTON COUNTY

1969

BENTON COUNTY, WASHINGTON

TABLE OF CONTENTS

GENERAL PROVISIONS

ORDINANCE NO. 62

AN ORDINANCE AMENDING AND REVISING THE ZONING RESOLUTION OF BENTON COUNTY ENTITLED "A RESOLUTION REGULATING AND RESTRICTING THE LOCATION AND USE OF BUILDINGS AND THE USE OF LAND WITHIN THE UNINCORPORATED PORTION OF BENTON COUNTY, WASHINGTON; PRESCRIBING YARDS AND OTHER OPEN SPACES: REQUIRING PERMITS FOR THE CONSTRUCTION AND OCCUPANCY OF BUILDINGS AND STRUCTURES OF CERTAIN KINDS AND USES: AND FOR THESE PURPOSES DIVIDING THE COUNTY INTO ZONING DISTRICTS; PROVIDING FOR THE ENFORCEMENT OF THIS RESOLUTION AND PROVIDING PENALTIES FOR THE VIOLATION OF ITS PROVISIONS" AS ADOPTED DECEMBER 9, 1946, AND AS AMENDED.

Be it ordained by the Board of Commissioners of Benton County, Washington:

SECTION 1. The Zoning Resolution of Benton County as adopted December 9, 1946, and amended May 11, 1948, July 14, 1949, December 3, 1951, July 7, 1954, December 9, 1954, and January 5, 1956, is amended by revising Section 1 through 27 to read as follows:

SECTION I. This Ordinance shall be known as the Zoning Ordinance of Benton County.

SECTION II. Purpose of Designation of Districts:

1. For the purpose of promoting public health, safety, morals and general welfare, and in accordance with the provisions of Chapter 44, Laws of Washington, Laws of 1935, all land within the unincorporated portion of Benton County shall be classified according to the following use districts:

(a) Residential District, R
(b) Suburban District, S
(c) Agricultural District, A
(d) Commercial District, C
(e) Industrial District, I-1
(f) Industrial District, I-2
(g) Landing Field District, L.F.
(h) Highway Scenic District, H.S.
(i) Parks and Recreation Areas, P.R.
(j) Unclassified, U

2. The boundaries of such use districts shall be as shown on the "Use District Maps," which have been and hereafter be adopted by resolution of the Board of County Commissioners as hereinafter in this Ordinance provided.

3. There shall bemaintained in the office of the County Auditor at all times; and, likewise, in the office of the Planning Commission, a map of the County showing the classification of all properties for use, according to this ordinance, which same shall be available for inspection by the public and which shall constitute the use maps of the County, and as changes of areas are made to any other use the same shall immediately be shown on such maps. A map of the entire County is hereto attached showing all of the County under the classification as set forththerein, and which same is made a part of this Ordinance.

4. That the owners of property within the County are afforded the opportunity and means through the medium of this Ordinance to change the classification and use of their property as now set forth on the map referred to in paragraph three supra, which means shall be accomplished only by the medium as hereinafter described in Sections 20 and 21 of this Ordinance. (As amended by Ordinance No. 68 adopted August 29, 1960, effective August 29, 1960.)

SECTION III. Definitions: For the Purpose of this Ordinance, certain words and terms are defined as follows:

Words used in the present tense include the future; words in the singular number include the plural, and words in the plural number include the singular.

1. "Accessory Use or Building": A subordinate use or building customarily incident to and located upon the same lot occupied by the main use or building.

2. "Apartment House": A building containing three or more family-dwelling units each of which, though independent of the other, is provided with joint service such as central heat, common hallways, common entrance or entrances to the building, janitor service, refuse disposal and similar services.

3. "Auto Camp": Any plot of ground where accommodation is provided for two (2) or more families of motorists or travelers to establish temporary or semipermanent residence in tents, automobile trailers, house cars, mobile homes, or other portable or temporary habitations.

4. "Auto Court": Any multi-family dwelling or group of dwellings which are designed or intended for the temporary or semi-permanent residence of motorists or travelers.

5. "Family": Any number of individuals living together as a single housekeeping unit, and doing their cooking on the premises exclusively as one household.

6. "Front Yard": The required open space between the front property line and the nearest part of any building on the lot, save as elsewhere in this Ordinance excepted.

7. "Front Property Line": The front property line as shown upon the official recorded plat of the property. In all cases where the front property line cannot be determined from a recorded plat, it shall be the property line abutting or adjoining a public road, street, highway, or lane. If there be more than one property line adjoining or abutting a public road, street, highway or lane, the front property line shall be considered to be the property line along the principal or main travelled public way. In the event there is question as to which public way is the principal one, the County Planning Commission shall, upon request from the County Engineer or any interested party, designate the front property line for any specific lot and such designation shall be final for the purposes of this Ordinance.

8. "Hotel": A house providing lodging and usually meals for the public, especially transients and not used as an auto court as defined in this Ordinance.

9. "Lot": The parcel of land on which a principal building and its accessory buildings are placed or are to be placed, together with the required open spaces; or a "lot" designated as such on an officially recorded plat.

Any subdivision of land by metes and bounds description prior to the adoption of this Ordinance and held under one ownership separate and distinct from the adjoining and abutting land shall be considered a "lot" as shown by the last conveyance of record.

When a tract of land consisting of more than one platted lot held under one ownership is to be developed as one unit, all the parcels or lots shall be considered as one lot for the purpose of this Ordinance.

10. "Multi-family Dwelling": A building arranged or designed to be occupied by more than two families, such as an apartment house, flat or rowhouse, but not including an auto court or trailer park.

11. "Public Garage": Any building or premises used for the storage or housing of more than three self-propelled vehicles (except farm implements used on the premises) or where such vehicles are repaired or kept for hire.

12. "Rear Property Line": The property line of a lot most nearly parallel to the front property line of the same lot as defined in this Ordinance except that for a triangular shaped lot the rear property line shall be represented by the point of intersection of the two property lines which are not the front property line as defined in this Ordinance.

13. "Rear Yard": The required open space on a lot extending along the rear property line through the whole width of the lot.

For triangular lots, the rear yard shall be the area of the lot lying within a circle having a radius equal to the depth of the required rear yard and its center at a point herein defined as the rear property line for such lots.

14. "Side Yard": The required open space on a lot between the side wall line of a building and the side line of the lot, and extending from the front yard to the rear yard.

15. "Single Family Dwelling": A building arranged or designed to be occupied by not more than one family.

16. Wherever the term "Planning Commission" occurs in this Ordinance it shall be deemed to refer to the Planning Commission of Benton County.

17. "Trailer Park": Any plot of ground where accommodation is provided for two (2) or more families to establish temporary or semi-permanent residences in automobile trailers, house cars, or other portable or temporary habitations whether the wheels have been removed from such portable habitations or not.

18. "Auto Wrecking or Junk Yards; Rubbish Dumps": A lot, parcel of land or structure, or part thereof, larger than 200 square feet, used for storage, keeping or abandonment of junk, including waste paper, rags, scrap metal, scrap lumber, or discarded material; or used for the collecting, dismantling, storage, salvaging, or sale of parts of machinery or vehicles not in operable condition; provided that this definition shall not be deemed to include lots used for the outdoor display and sale of used vehicles in operable condition; nor shall it include that part of a farm used for the storage of agricultural machinery kept for salvage by the owner for his own use, and not for sale, on farms having an area of not less than 40 acres. (By Ordinance No. 75 adopted and passed June 25, 1962.)

19. "Kennels": The keeping of three or more dogs, four months or more old, whether owned personally or boarded. (By Ordinance No. 82 adopted and passed August 8, 1966.)

SECTION IV. Residential District (R):

1. In the Residential District, no building or premises shall be used nor shall any building or structure be hereafter erected or altered unless otherwise provided in this resolution, except for one or more of the following uses:

A. One or two-family dwellings.

B. Schools (except trade or industrial schools), churches, libraries, art galleries or public museums.

C. The usual accessory buildings commonly appurtenant to any of the above uses when located on the same lot with such use, and when located not less than seventy-five (75) feet from the front property line of the lot nor less than ten (10)dfeet from any other street line, except that a private garage may be constructed as a part of a dwelling.

D. The keeping of not to exceed five (5) boarders and/or lodgers in any one-family dwelling unit.

E. The office of a physician, dentist, lawyer, musician, or other professional person, also home occupations engaged in by individuals within his or her dwelling, provided no professional office or home occupation shall constitute the principal use of the premises or occupy more than thirty (30) per centum of the usable floor space of a dwelling. Nothing in these provisions shall be interpreted to authorize the employment of any person in connection with a professional office or a home occupation other than individuals actually residing in the dwelling where such use is located, either as a member of the family or as a servant. The display or sale of material or products, other than agricultural products raised on the premises where sold, shall not constitute a home occupation.

F. Not more than two (2) signs, not exceeding one (1) square foot in area for each sign, bearing only the name and occupation of the occupant.
Not more than two (2) signs, not exceeding one (1) square foot in area, advertising for sale or rent the premises upon which they are located.

G. The keeping of not more than twenty-four chickens exclusive of chicks not over six (6) months old, provided that all chicken houses, yards or runs are not less than seventy-five (75) feet from the front property line and not less than twenty (20) feet from any adjoining property line or are within the rear yard as defined in this resolution.

H. On any tract of land having an area of not less than thirty thousand (30,000) square feet and an average width of not less than one hundred (100) feet, the following uses are permitted as accessories to a family dwelling: The keeping of one (1) cow or two (2) goats and/or not more than two (2) riding horses and/or not more than thirty-six chickens exclusive of suckling animals or chicks not over six months old provided that all barns, barnyards or corrals shall be located not less than seventy-five (75) feet from any public road, street or highway and not less than thirty (30) feet from any property held under different ownership from that upon which such animals or poultry are kept.

I. Vacant land may be used for gardening or fruit raising.

J. Any of the following uses may be allowed by special permit issued by the County Planning Commission after notice and public hearing as provided by Section 18 of this Ordinance.

(1) Community Club Houses
(2) Golf Courses
(3) Parks or Playgrounds
(4) Nurseries or greenhouses
(5) Public Utilities such as substations, telephone exchanges and bus depots.
(6) Temporary offices used in the development of real estate or natural resources.

2. Building Site

A. No one-family dwelling shall hereafter be erected upon any lot or plot having an area of less than seven thousand five hundred (7,500) square feet nor an average width of less than seventy-five (75) feet. No two-family dwelling shall hereafter be erected upon any lot or plot having an area of less than ten thousand (10,000) square feet nor an average width of less than ninety (90) feet. Nothing in these regulations shall prevent the erection of one (1) one-family dwelling upon any lot or plot or record at the time of adoption of this Ordinance and that is of separate and distinct ownership from any adjoining property.

B. The Planning Commission may because of special conditions such as topography and the like accept a plat with lots less than this seventy-five (75) feet minimum width but in so doing it shall order a record of same to be placed upon the plat.

3. Front Yard:

A. There shall be a front yard set back of not less than fifty-five (55) feet from center line of any street or roadway of sixty (60) feet or less. If the roadway exceeds sixty (60) feet, the set back then shall not be less than twenty-five (25) feet from the property line.

B. No building shall be hereafter erected or altered so any portion thereof shall be nearer to the front property line than the distance indicated in the preceding sub-paragraph A, except eaves, cornices, belt course, and similar ornamentations may project over a front yard not more than two (2) feet. Steps, terraces, platforms, and porches having no roof covering and being not over forty-two (42) inches in height may extend into a front yard.

4. Side Yard:

A. There shall be a side yard of not less than ten (10) feet on each side of the building, provided that on a corner lot the side yard on the flanking street shall not be less than twenty-five (25) feet. (As amended by Ordinance No. 83 adopted and passed November 3, 1966.)

B. No building shall be hereafter erected or altered so that any portion thereof shall be nearer to the side lot line than the distance indicated by the width of the required side yard, except.

(1) Eaves, cornices, belt courses, and similar ornamentations may extend over a side yard for a distance of not more than two (2) feet.

(2) Platforms, terraces, and steps, not over forty-two (42) inches in height may extend into a side yard.

(3) Accessory buildings when located not less than one hundred (100) feet from the front property line or when the entire building is not more than thirty-five (35) feet from the rear property line may occupy the side yard along an inside lot line.

(4) Fireplaces may extend into a side yard a distance of not more than eighteen (18) inches.

5. Rear Yards:

A. There shall be a rear yard of not less than twenty-five (25) feet.

B. No dwelling or multiple family dwelling shall be hereafter erected or altered so that any portion thereof may be nearer to the rear lot line than the distance indicated by the depth of the required rear yard, except, eaves, cornices, steps, platforms, and open porches may extend into the rear yard.

C. In a residence district, not more than forty (40) per centum of the rear yard may be occupied by accessory or other buildings.

6. Access to Public Road.

Every dwelling of multi-family dwelling shall front upon and have direct access to a road, street, highway, or lane dedicated to the use of the public. No other building shall intervene between a dwelling or multi-family dwelling and the street upon which it fronts.

SECTION V. Suburban District (S)

1. In the suburban district, no buildings or premises shall be nor shall any building or structure be hereafter erected or altered, unless otherwise provided in this Ordinance, except for one or more of the following uses:

A. Any use permitted in the Residential District.

B. Multiple family dwellings such as flats, apartments, boarding and lodging houses.

C. Hospitals, sanitariums, and institutions for philanthropic or eleemosynary purposes other than correction (Subject to the approval of the County Health Officer.)

D. Trade or industrial schools.

E. Horticultural, floriculture and truck gardening.

F. Accessory buildings including one temporary and movable stand for the display and sale of products raised or grown on the premises upon which such a stand is located. All such temporary stands shall be located not less than twenty (20) feet from any street or highway during the season it is actually being used for the display and sale of farm products; at all other times, it shall be located elsewhere in the manner designated for other accessory buildings. Accessory Buildings shall be located not less than seventy-five (75) feet from the front property line and not less than ten (10) feet from any other street line except that a private garage may be constructed as a part of a dwelling.

A storage garage containing not more than one car stall for each family dwelling unit may be considered as an accessory to a multiple family dwelling.

G. Not more than two (2) signs having an area of not more than six (6) square feet in each sign, advertising the sale of products raised or grown on the premises.

H. Work horses actually used in connection with the agricultural uses permitted, provided that no stable, barn yard, or corral shall be located less than seventy-five (75) feet from any dwelling or public street or highway.

I. Any of the following uses may be allowed by special permit issued by the County Planning Commission after notice and public hearing as provided in Section XVIII of this Ordinance.

(1) Amusement parks.
(2) Auto Camps, auto courts, or trailer parks; provided that there shall be not less than one thousand (1,000) square feet of lot area for each family or housekeeping unit.
(3) Cemeteries, crematoriums or mausoleums.
(4) Hotels with stores therein.
(5) All types of agriculture not otherwise permitted.
(6) Dairying and stock raising except the raising of swine commercially, provided that no permit shall be issued for dairying or stock raising on any tract of land having an area of less than nine (9) acres, or for animal sheds or barns, to be located less than one hundred (100) feet from any public street or highway or less than one hundred (100) feet from any property held under different ownership from that upon which such shed or barn is located.
(7) Kennels or small animal farms, poultry or squab farms, subject to such restrictions as the County Planning Commission deems necessary.

2. Building Site

A. One - or two family dwellings.

No one - or two-family dwellings shall hereinafter be erected upon any lot or plot having an area of less than ten thousand (10,000) square feet nor an average width of less than ninety (90) feet, provided, that nothing in this Ordinance shall prevent the erection of one (1) one-family dwelling upon any lot or plot of record at the time of adoption of this Ordinance and of separate and distinct ownership from any property.

B. Multiple Family Dwellings.

No multiple family dwellings such as an apartment house, hotel, or flat shall hereafter be erected upon any such lot or plot having an area of less than ten thousand (10,000) square feet or an average width of less than ninety (90) feet, nor shall any multiple family dwelling, other than a hotel catering only to transient guests, hereafter be erected or altered in such a manner as to provide less than five hundred (500) square feet of open, unoccupied lot area for each family unit, in such multiple family dwelling.

The Planning Commission may, because of special conditions such a topography and the like, accept a plot with less than this ninety (90) feet minimum width, but in so doing shall order a record of same to be place upon the plat.

3. Front Yards

A. There shall be a front yard set back of not less than fifty-five (55) feet from the center line of the street or roadway of any road of sixty (60) feet or less. If the roadway exceeds sixty (60) feet the setback then shall not be less than twenty-five (25) feet from the front property line.

B. Whenever, by special permit, more than one dwelling, building or tourist cabin is erected upon a lot or plot, each such dwelling shall be separated from every other such dwelling by a distance of not less than ten (10) feet.

4. Side Yard

Same requirements as in residential Zone (Section IV, Paragraph 4.)

5. Rear Yard

Same requirements as in Residential Zone, except the provisions of Section IV, Paragraph 5 (C) thereof, (Section IV, Paragraph 5 (A) and (B).

6. Access to public roads.

Every dwelling or multi-family dwelling shall front upon and have direct access to a road, street, highway or lane, dedicated to the use of the public. No other building shall intervene between a dwelling or multi-family dwelling and the street upon which it fronts. (As amended by Ordinance No. 66 adopted March 23, 1960, effective March 23, 1960.)

SECTION VI: Agricultural District, (A)

1. In the Agricultural District, no building or premises shall be used nor shall any building or structure hereafter be erected or altered, unless otherwise provided in this resolution, except for one or more of the following uses:

A. Any use permitted in the Residential District.

B. Agricultural, floriculture, horticulture, general farming, dairying, poultry raising and stock raising except commercial hog ranches.

C. Stands for the display and sale of products raised or grown on the premises when located not less than twenty (20) feet from any public street or highway.

D. Not more than two (2) signs, having an area of not more than six (6) square feet in each sign, advertising the sale of products raised on the premises.

E. Accessory buildings ordinarily appurtenant to the Conduct of farming and agriculture and when located not less than seventy-five (75) feet from any public street or highway.

F. Community club houses, golf courses, parks and playgrounds, and public utility buildings, such as pumping plants and substations.

G. Stills, packing sheds or warehouses for the processing or protection of agricultural products.

H. Any of the following uses may be allowed by special permit issued by the County Planning Commission after notice of Public hearing as provided in Section 18 of this Ordinance.

(1) Any use not otherwise permitted that is permitted in the Suburban Districts.
(2) Industrial or manufacturing plants such as feed mills, canneries, sand and gravel pits, stone quarries and similar uses for processing of agricultural products or the development of natural resources.
(3) Swine raising, provided that no permit shall be issued for commercial hog ranches within a distance of five hundred (500) feet from any dwelling other than the dwelling situated on the same premises with such hog ranch or within a distance of three hundred (300) feet from any public street or highway.
(4) Summer resorts, dance halls, and similar uses.
(5) Outdoor advertising signs or billboards.

2. Building Site

No site area required except that all dwellings, multiple family dwellings, auto courts, auto camps or trailer parks, when permitted, shall conform to the building site regulations as are required for such buildings in the Suburban District.

3. Front Yards

There shall be a front yard set back of not less than fifty-five (55) feet from the center of the road and if the road be sixty (60) feet or more there shall be a setback of at least twenty-five (25) feet from the front property line.

4. Side and Rear Yards

No side or rear yard is required except that all dwellings, multiple dwellings, auto camps, auto courts, and trailer parks shall conform to the side and rear yard regulations as required for such buildings in the Suburban District.

SECTION VII: Commercial District (C)

1. In the Commercial District, no buildings or premises shall be used nor shall any building or structure be hereafter erected, unless otherwise provided in this resolution, except for one or more of the following uses:

A. Any dwelling or multiple family dwelling use permitted in the Suburban District, provided that the "Building Site" and "Yard" requirements of the suburban District for such uses shall apply in the same manner as if such dwelling or multiple family dwelling were, in fact, located within the Suburban District.

B. Automobile repairs, when conducted entirely within a building.

C. Automobile sales, service, or storage of automobiles in good operable condition.

D. Banks, business or professional office.

E. Bilboards and outdoor advertising in conformity with other Ordinances or regulations governing the same.

F. Dry cleaning and laundry branch offices but not including dry cleaning plants or laundries.

G. Fruit and vegetable markets.

H. Printing plants and newspapers.

I. Retail Bakeries.

J. Retail stores of all descriptions where the merchandise is displayed and sold within the building.

K. Shops for the repair or servicing of all sorts of household equipment.

L. Taverns or beer parlors in accordance with regulations of Benton County.

M. Theaters, dance halls, skating rinks and other lawful commercial amusement enterprises.

N. Undertaking and funeral homes.

O. Manufacturing employing not more than five (5) persons, only to the extent that the manufacturers articles are sold at retail on the premises where manufactured and only if there is no noise or vibration-producing power machinery used in the process; and the materials or methods used produce no odors, dust, smoke or fumes.

P. Public Utilities: For construction of telephone exchanges, sewage pumping stations, electrical distribution sub-stations, gas (natural or synthetic) regulatory stations, which utilities are subject to rules and regulations of Washington Utilities and Transportation, commercial and irrigation and domestic water pumping stations. (By Ordinance #78 adopted and passed August 19, 1963.)

2. Building Site:

No building site regulations except that all dwellings, multiple family dwellings, auto camps, auto courts, or trailer parks, when permitted shall conform to the building site regulations for such buildings as are required in the Suburban District.

3. Front, Side and Rear Yards.

A. No front yard is required for any property fronting upon a street or highway having a width of one hundred (100) feet or more except as required for all dwellings or multiple family dwellings by Paragraph 1 of this Section.

B. For any property fronting upon a street or highway having a width of less than one hundred (100) feet there shall be a front yard having a depth of not less than that determined by the following formula:

$$50-\frac{W}{2} = \text{Depth of Front Yard}$$

W= Width of the highway or street upon which the property fronts.

C. No side or rear yard is required except as required for all dwellings or multiple family dwellings by Paragraph 1 of this Section.

SECTION VIII. Industrial (I-1)

In the Industrial District I-1, no building or premises shall be used nor shall any building or structure be hereafter erected or altered, unless otherwise provided in this Ordinance, except for one or more of the following uses:

1. Any use permitted in the Residential District, Agricultural District, or Commercial District provided that the "Building Site": and "Yard" requirements of the Suburban Districts shall apply to all dwellings and multiple family dwellings as if such dwellings or multiple family dwellings were, in fact, located within the Suburban District.

2. Any use, trade, or industry not otherwise prohibited by law except the following:

A ---

1. Abattoirs
2. Acetylene Gas Manufacture or Storage
3. Acid Manufacturers
4. Ammonia, bleaching powder, or chlorine manufacture
5. Arsenal
6. Asphalt manufacture or refining
7. Blast furnace
8. Boiler works
9. Brick, tile, terra cotta manufacture
10. Candle Manufacture
11. Bag cleaning
12. Celluloid manufacture
13. Coke ovens
14. Crematory
15. Creosote treatment or manufacture
16. Disinfectants manufacture
17. Distillation of bones, coal or wood
18. Dyestuff manufacture
19. Exterminator and insect poison manufacture
20. Emery cloth and sand paper manufacture
21. Fat rendering
22. Fertilizer manufacture
23. Fireworks or explosive manufacture or storage
24. Fish smoking and curing
25. Forge plant
26. Gas (illuminating or heating) manufacture
27. Glue, size or gelatin manufacture
28. Gunpowder manufacture or storage
29. Incineration or reduction of garbage, dead animals, offal, or refuse
30. Iron, steel, brass or copper factory
31. Lamp black manufacture
32. Oilcloth or linoleum manufacture
33. Oiled, rubber or leather goods manufacture
34. Ore reduction
35. Paint, oil, shellac, turpentine, or varnish manufacture
36. Paper and pulp manufacture
37. Perfume manufacture
38. Petroleum product, refining, or wholesale storage of petroleum
39. Plating works
40. Potash works
41. Printing ink manufacturing
42. Pyroxlin manufacture
43. Rock crusher
44. Rolling mill
45. Rubber or Gutta Porcha manufacture or treatment
46. Salt works
47. Sauerkraut manufacture
48. Shoe blacking manufacture

49. Smelters
50. Soap manufactures
51. Soda and compound manufacture
52. Stockyards
53. Stone mill or quarry
54. Storage or bailing of scrap paper, bottles, iron, rags, or junk
55. Stove polish manufacture
56. Sulphuric, Nitric, or Hydrochloric Acid manufacture
57. Tallow, grease, or lard manufacturing or refining of animal fat.
58. Tanning, curing, or storage of raw hides or skins
59. Tar distillation or manufacture
60. Tar roofing or water proofing manufacture
61. Tobacco (chewing) manufacture or treatment
62. Vinegar manufacturing
63. Wool pulling or scouring
64. Yeast plant
65. And in general those uses which have been declared nuisances in any court of record, or which may be obnoxious or offensive by reason of emission of odor, dust, smoke, gas, or noise; provided that any of the foregoing prohibited uses may be allowed by special permit issued by the County Planning Commission after notice and public hearing as provided by Section XVIII of this Ordinance.

3. Building Site

No building site regulations except that all dwellings, multiple family dwellings, auto courts, auto camps, trailer camps, when permitted shall conform to the building site regulation for such buildings as are required in the Suburban Zone.

4. Front, Side and Rear Yards

A. No front yard is required for any property fronting upon a street or highway having a width of one hundred (100) feet or more except as required for all dwellings or multiple family dwellings by Paragraph 1 of this Section.

B. For any property fronting upon a street or highway having a width of less than one hundred (100) feet there shall be a front yard having a depth of not less than that determined by the following formula:

$$50-\frac{W}{2} = \text{Depth of Front Yard}$$

W = Width of the highway or street upon which the property fronts.

C. No side or rear yard is required except as required for all dwellings or multiple family dwellings by Paragraph 1 of this Section.

SECTION IX: Industrial District (I-2)

In the Industrial District, I-2, all buildings and premises, except as otherwise provided by this or other ordinances, may be used for any use except the following:

1. All dwellings or multi-family dwellings except dwellings for occupancy of caretakers, watchmen or guards employed at industries where such dwellings are located.

2. Building Site

No restrictions except as may be required by other Ordinances.

3. Front, Side and Rear Yards

A. No front yard is required for any property fronting upon a street or highway having a width of one hundred (100) feet or more.

For any property fronting upon a street or highway, having a width of less than one hundred (100) feet there shall be a front yard having a depth of not less than that determined by the following formula:

$$50-\frac{W}{2} = \text{Depth of Front Yard}$$

W = Width of the highway or street upon which the property fronts.

B. No side or rear yard is required.

SECTION X: Landing Field (L-F)

(Property adjacent to landing fields and airports)

1. The landing field district shall include all approaches to now existing and recognized landing fields and airports.

2. Such district will be considered an area surrounding existing landing and taxying strips within twenty-five hundred (2,500) feet from such longitudinal extremity of the strips (2,500 feet at both ends) and within three hundred feet (300) from each extreme side edge of the strips.

3. Within this area there shall not be placed any obstructions. Owners of such property may not erect any buildings or structures without first applying for re-zoning before the Planning Commission which will conduct a survey of the area in order to determine to what extent, if any, proposed improvements may constitute hazards to landing planes. In reaching a decision, the Planning Commission shall list carefully all factors upon which its decision was made.

SECTION X A. Highway Scenic District (H.S.)

1. Highway Scenic Districts may be designated and established on one or both sides of any highway in combination with any other zoning District where roadside scenic vistas are available to the passing motorist. Within the considered H.S. Districts, no outdoor advertising structure or signs shall be permitted. Provided, however, that in H.S. Districts combined with Residential, Suburban or Agricultural Districts, signs shall be permitted as provided in the Ordinance for those Districts; and, Provided further, that where a H.S. District is combined with an unclassified District, only those signs permitted in a Suburban or Agricultural District will be authorized.

2. No person, firm, or corporation, except as set forth in the provisions of Section 1, supra, shall, thirty days after the effective date of this amendment, erect or maintain upon any real property in the County of Benton outside the corporate limits of any City or Town any outdoor advertising structure until a permit for the erection and maintenance of same shall have been obtained from the County Official duly authorized for this purpose.

3. An application shall be made to the County Official duly authorized for this purpose for each outdoor advertising structure to be erected and maintained and each application shall be accompanied by a fee of one dollar ($1.00). The application shall be in writing upon forms furnished by the County Official duly authorized to do so and shall contain the full name and post office address of the applicant and such other information as said official may require, and shall be signed by the applicant or his duly authorized agent. The application for a permit shall also state the location of the structure for which the permit is asked and shall be accompanied by construction drawings; Provided, that this Section shall not apply to signs allowed in Residential, Suburban and Agricultural Districts and as to Unclassified Districts per Section 1 supra.

4. No permit shall be granted for the erection, construction or maintenance of any outdoor advertising structure which does not conform with the zoning code of Benton County.

5. Signs and advertising structures shall be prohibited within the following territories:

(a) Within a distance of three hundred (300) feet of the intersection or junction of a state highway or county F.A.S. Secondary with another State or County F.A.S. Secondary Highway, or with a railway at a point where it would obstruct or interfere with the view of a vehicle, train or other moving object on the intersecting or joining highway or railway.

(b) If placed along any highway in such a manner as to prevent a clear view of vehicles approaching within a distance of five hundred feed (500) along said highway.

(c) If placed closer than the frontyard set back for the residential zone.

(d) If placed within one thousand (1,000) feet of any public park or public play-ground and in public view therefrom.

6. Erection or maintenance of the following is prohibited:

(a) Any advertising sign, if visible, from any highway which simulates any directional, warning or information sign if likely to be construed as giving warning to traffic, such as the use of the words "stop", "slow down", etc.

(b) Any outdoor advertising structure on private property the written consent from the owner of which has not been obtained.

7. All outdoor advertising structures, together with supports, braces, guys, and anchors, shall be kept in good repair and in a proper state of preservation. (As enacted by Ordinance No. 68 adopted and passed August 29, 1960.)

SECTION XI: Parks and Recreation Areas (P-R)

Districts designated as Parks and Recreation areas are usually publicly owned. From time to time projects for parks and playground improvements will be initiated by the Planning Commission or the Board of County Commissioners. The development of such projects shall be restricted only by action of the duly authorized instrumentalities having jurisdiction over same.

SECTION XI-A. Unclassified District (U)

1. In the Unclassified District, all uses of property not otherwise prohibited by the laws of Benton County or the State of Washington are permitted except the following enumerated uses, trades, or industries may be allowed only by special permit issued by the County Planning Commission (a) after notice and public hearing as provided by Section 18 of this Ordinance, or (b) in lieu of the notice and public hearing any of the foregoing uses may be allowed by special permit issued by the County Planning Commission or its authorized representatives when such use is located not less than one thousand (1,000) feet from any church, school park, playground, or occupied dwelling except such dwellings as may exist upon the same premises with such use, and when located not less than one thousand (1,000) feet from any Residential, Suburban, or Commercial District and not less than five hundred (500) feet from any primary or secondary State or County highway and not less than one (1) mile from the limits of any incorporated city or town:

(1) Acid manufacture
(2) Asphalt mixing plants
(3) Auto wrecking or junk yards
(4) Cement, lime or gypsum manufacture
(5) Distillation of bones
(6) Explosives storage or manufacture
(7) Fertilizer works

(8) Garbage, offal, or dead animal reduction or disposal
(9) Gasoline or oil storage above ground except petroleum products stored for private use
(10) Glue manufacture
(11) Oil refining
(12) Rubbish dumps
(13) Ranches maintained for the purpose of garbage disposal by feeding the same to animals
(14) Slaughter houses

2. Building Site

No regulations.

3. Front, Side and Rear Yards

No front yard required except for property fronting upon a street or highway having a width of less than one hundred (100) feet, in which case there shall be a front yard not less in depth than that determined by the following formula:

$\frac{50-W}{2}$ = Depth of front yard

W = Width of street or highway upon which the property fronts.

4. No side or rear yard required.

GENERAL PROVISIONS

SECTION XII: Building Permits

1. No person, company, or corporation shall erect a building or structure of any kind or make any addition to an existing building or structure or alter any building or structure already erected within the unincorporated area of the County of Benton without first obtaining a permit in writing from a County Official duly authorized for this purpose.

2. The application for such permit and regulations governing construction, shall be as prescribed by the Benton County Building Code.

SECTION XIII: Front Yards as set forth for

Residential in Section IV (3); for
Suburban in Section V (3); for
Agriculture in Section VI (3); for
Commercial in Section VII (3); for
Industrial I-1 in Section VIII (4); for
Industrial I-2 in Section IX (3); for
Unclassified U in Section XI-A (3)

SECTION XIV: Side Yards

As set forth for

Residential in Section IV (4); for
Suburban in Section V (4); for
Agriculture in Section VI (4); for
Commercial in Section VII (3); for
Industrial (I-1) in Section VIII (4) (c); for
Industrial (I-2) in Section IX (3); for
Unclassified (U) in Section XI-A (3 &4)

SECTION XV: Rear Yards

As set forth for

Residential in Section IV (5); for
Suburban in Section V (5); for
Agriculture in Section VI (4); for
Commercial in Section VII (3) (c); for
Industrial (I-1) in Section VIII (4) (c); for
Industrial (I-2) in Section IX (3) B; for
Unclassified (U) in Section XI-A (3 & 4)

SECTION XV-A: Access to Public Roads

Every dwelling or multi-family dwelling in any District shall front upon and have direct access to a road, street, highway or lane, dedicated to the use of the public. No other building shall intervene between a dwelling or multi-family dwelling and the street upon which it fronts. (As enacted by Ordinance No. 66, adopted March 23, 1960, effective March 23, 1960.)

SECTION XVI: Non-Conforming Uses

1. The lawful use of the land or premises existing at the time of adoption of this Ordinance, although such use does not conform to the provisions of this Ordinance, may be continued; but if such nonconforming use is discontinued for a period of one year or more, any further use of these lands or premises shall be in conformity with the provisions of this resolution. The mere presence of a structure shall not be deemed to constitute the continuance of a non-conforming use unless such structure is actually occupied and employed in maintaining such uses.

2. Nothing in this Ordinance shall be deemed to prohibit the restoration of a building within a period of six (6) months from the date of its partial destruction to the extent of not more than fifty (50) per cent of its replacement value by fire, explosion, act of God, of the public enemy, or prevent the continuance of the use of such building or part thereof.

3. That in an Industrial District (I-2), as set forth in Section IX, any existing single family dwelling unit therein at the time said land is zoned I-2, may be enlarged, altered, or replaced, provided that no additional dwelling units are added, and that any existing dwelling units being replaced are razed. (By Ordinance No. 75 adopted and passed June 25, 1962.)

SECTION XVII: Ownership Divided by a District Boundary Line.

1. If a district boundary line cuts a property, having a single ownership as of record at the time of adoption of this Ordinance, in such a manner that the property so cut shall have one or more parcels of different classification, then each such parcel having an area of less than ten thousand (10,000) square feet or an average width of less than sixty (60) feet may take the same classification as the adjoining parcel of the same ownership.

SECTION XVIII: Special Permits.

1. Recognizing that there are certain uses of property that may or may not be detrimental to the public health, safety, moral and general welfare depending upon the facts in each particular case, a limited power to issue special permits for such uses is vested, by specific mention in this Ordinance, in the County Planning Commission, and the County Planning Commission shall have the power to place in such permits, conditions or limitations in its judgment required to secure adequate protection to the zone or locality in which such use is to be permitted. Likewise, the County Planning Commission shall have power, after public hearing, to terminate any permits so issued for any violation of the terms or limitations therein prescribed.

2. Before granting any permit under the provisions of this section, the County Planning Commission shall hold a public hearing, at which time the applicant and other interested parties have been given an opportunity to be heard. Such public hearing shall be held after not less than ten (10) days notice given in the following manner:

A. By United States Mail addressed to the applicant and to the owners of all adjoining or abutting property. (Property separated from the proposed use by a street, highway or other public road or alley shall be construed to be adjoining or abutting for the purpose of giving notice, and notices addressed to the last known address of the person making the latest tax payment shall be deemed proper notice to the owner of such property.)

B. By not less than two printed or written notices posted in a conspicious place at or near the location of the proposed use.

3. To defray the cost of examination of the application and posting of notices, the County Planning Commission may require that a fee of not more than twenty=five dollars ($25.00) accompany all applications for permits under the provisions of this section, said fee to be upon a graduated scale based upon the estimated cost of making said examination and set forth in a schedule to be adopted by the County

Planning Commission. All fees so collected shall be transmitted by the County Planning Commission to the County Treasurer, who shall deposit the same in the general fund of Benton County.

SECTION XIX: Interpretation

1. In interpreting and applying the provisions of this Ordinance, the Planning Commission shall be held to the minimum requirements for the promotion of the public health, safety, morals, and general welfare; therefore where this Ordinance imposes a greater restriction upon the use of buildings or premises, or requires larger open spaces than are imposed or required by other laws, resolutions, rules, or regulations, the provisions of this Ordinance shall control.

2. The County Planning Commission may permit in a zone any use not described in this resolution and deemed by the County Planning Commission to be of the same character and general keeping with the uses authorized in such zone.

3. The County Planning Commission shall rule on the proper application or interpret the meaning of the zoning Ordinance in case there is a dispute between the administrative officials of the County and any owner or owners of property.

4. The County Planning Commission shall interpret the provisions of this Ordinance in such a way as to carry out the intent and purpose of the plan thereof, as shown on the district maps herein or hereafter adopted, where the street layout actually on the ground differs from that shown on the maps aforesaid.

5. The County Planning Commission, may in specific cases where topography makes compliance with the provisions governing the location of a building impractical or impossible, grant a special permit for such a building to be located in variance with the provisions of this Ordinance.

SECTION XX: Amendments

The Board of Commissioners may, upon recommendation of the County Planning Commission and, after public hearing, change by resolution the District Boundary lines or zone classification as shown on the use district maps, and, or, amend, supplement or change by resolution the regulations herein contained. When said recommendation is made by the County Planning Commission, said Commission shall cause a survey of the existing land uses and resources of such subdivision of the County to be made as expediently as funds and circumstances permit; and shall prepare a preliminary classification of all property within such subdivision of the county in one or more of the use districts provided in this Ordinance. After holding at least one public hearing within the proposed subdivision of the recommendation for change to be recommended to the Board of County Commissioners, the County Planning Commission shall transmit to the Board of County Commissioners its recommendations for the classification of all property in the proposed district. The Board of County Commissioners, upon receipt from the Planning Commission of said recommendations for change, shall proceed to hold one public hearing and, after said hearing, may adopt, alter, or reject by resolution the recommended change in district boundary lines, zone classifications, or regulations.

SECTION XXI: Petitions for Change of Classification

The owner of any property may petition the County Planning Commission for a change in classification. In addition to the signature of the record owner or owners of the property to be reclassified, such petition shall bear the signatures of the owners of three (3) of the five (5) lots, plots or parcels of property held under separate ownerships and nearest to the proposed zone change; and, in addition, shall bear the signatures of not less than 51 per cent of the owners of all property lying within a distance of 200 feet (streets and alleys included) of the proposed zone change.

The signatures of any person or persons having a contract right, as purchaser to receive title to any lot or parcel of property upon completion of the purchase price thereof; shall, for the purpose of this Ordinance, be deemed the signature of the owner of such property provided that the said person or persons state in writing over their signature that they are purchasing the property in question under contract.

All petitions requesting classification or change in classification of property must state the address of each signer and the legal description of the property owned by him.

The County Planning Commission shall hold, not less than one, public hearing within the area of the proposed zone change on all valid petitions for change of classification; and shall transmit, thereafter, the petition with their findings and recommendations to the Board of County Commissioners, who may adopt or reject by resolution such proposed zone change.

SECTION XXII: Appeals

Any interested citizen or administrative official may appeal to the Board of County Commissioners from any ruling of the County Planning Commission adverse to his interest, by filing with the Secretary of the Planning Commission within ten (10) days from such ruling, a written notice of appeal. Thereupon the Secretary of the Planning Commission shall, forthwith, transmit to the Board of County Commissioners all papers constituting a record upon which the action appealed from was taken and, in addition thereto, the Board of County Commissioners may, at its hearing, receive such additional evidence as seems to it relevant. Upon due hearing, the Board of County Commissioners shall have the power to overrule or alter any such ruling of the Planning Commission.

SECTION XXIII: Enforcement

It shall be the duty of the Planning Commission and its duly authorized agents to enforce this resolution through proper legal channels. The Commission shall not approve any plans or issue any permit for construction, alteration, or repair of any building or part, thereof, unless such plans and intended use of such building conform in all respects with the provisions of this resolution.

SECTION XXIV: Penalty

Any person, firm, or corporation who violates, disobeys, omits, neglects, or refuses to comply with or who resists the enforcement of any of the provisions of this resolution shall be guilty of a misdemeanor and shall be fined in any sum not to exceed three hundred ($300.) dollars, or imprisoned in the County Jail for a term of not exceeding ninety (90) days, for each offense. Each day that a violation is permitted to exist shall constitute a separate offense.

SECTION XXV: Validity

Should any section, clause or provision of this resolution be declared by the Court to be invalid, the same shall not affect the validity of the resolution as a whole or any part thereof other than the part so declared to be invalid.

SECTION XXV-A: Conflicting Provisions

All resolutions or parts of resolutions in conflict herewith are hereby repealed.

SECTION XXVI:

This resolution shall take effect and be in force thirty (30) days from and after its passage on December 9, 1946.

ADOPTED AND PASSED THIS 9th day of December, 1946.

This resolution concurred in and recommended for adoption this 9th day of December, 1946, by Benton County Planning Commission.

SECTION 2.

Except as expressly altered, limited, repealed or revised by the above and foregoing, the pertinent portions and provisions of the zoning resolution as adopted December 9, 1946, and amended shall remain in full force and effect and including all violations and penalties for violations prescribed therein.

SECTION 3.

Should any section, clause or provision of this Ordinance, as hereby amended and revised, be declared by the Court to be invalid, the same shall not effect the validity of the Ordinance or Resolution being amended and revised, as a whole or any part thereof of either, other than that part so declared to be invalid.

SECTION 4.

This Ordinance amending and revising the Zoning Resolution of Benton County shall take and be in force upon its passage and adoption.

ADOPTED AND PASSED this 15th day of February 1960.

BOARD OF COUNTY COMMISSIONERS,
BENTON COUNTY, WASHINGTON

WES P. BROWN
Chairman

JOHN DAM
Member

J. T. BETTINSON
Member

EXHIBIT 3

DALE E. BEAN
County Engineer

Telephone 984-3255

BENTON COUNTY
OFFICE OF THE COUNTY ENGINEER
Post Office Box 110
Prosser, Washington 99350

January 5, 1971

Mr. S. K. Billingsley
Washington Public Power Supply System
P. O. Box 6510
Kennewick, Washington 99336

Subject: Zoning Status -
Township 11 North, Range 28 East, W.M.

Dear Mr. Billingsley:

We have reviewed the zoning status established by the Benton County Planning Commission for the area you propose as the location for Hanford No. 2.

The area in Township 11 North, Range 28 East proposed by the Supply System as the site for Hanford No. 2 is located in an area zoned as "unclassified" and the use of that area for the construction and operation of a nuclear generating project is consistent with zoning ordinances prepared by the Benton County Planning Commission.

We have previously furnished you with a map showing the county zoning for the area within a 25 mile radius of the proposed nuclear plant site. The map is color coded to show the different zones. All the area not colored is zoned unclassified. You have also been furnished a copy of the Benton County zoning ordinance to identify allowable land uses in each zone.

Sincerely,

Robert J. Kuhta

ROBERT J. KUHTA
Engineer-Planner

RJK:afw

CC: Board of County Commissioners

EXHIBIT 4

$15,000,000
WASHINGTON PUBLIC POWER SUPPLY SYSTEM

A Municipal Corporation and a Joint Operating Agency of the State of Washington

3.05% Nuclear Project No. 2 Revenue Notes

Dated: January 1, 1971 **Due: July 1, 1974**

Principal and semi-annual interest (January 1 and July 1) payable at Marine Midland Bank-New York, New York, New York or Seattle Trust & Savings Bank, Seattle, Washington. The Notes will be in coupon form in the denomination of $25,000, or any multiple of $5,000 greater than $25,000.

The Notes will be subject to redemption at the option of the Supply System prior to maturity on or after July 1, 1973 as a whole at any time, upon payment of the principal amount thereof, together with the interest accrued thereon to the date fixed for redemption.

Interest exempt, in the opinion of Bond Counsel, from Federal Income Taxation under Existing Law and the Specific Ruling received from the Internal Revenue Service with respect to the Notes (See statement under the caption "Tax Exemption" herein).

The Notes are being issued to finance the preliminary expenses in connection with the Supply System's Nuclear Project No. 2 The Project will be constructed and operated by the Supply System in accordance with an agreement between the Supply System and the Bonneville Power Administration. The Project capability will be purchased under agreements (the "Net Billing Agreements") between the Supply System, Bonneville and 95 statutory preference customers of Bonneville (the "Participants"), 9 of which will initially purchase a zero share (the City of Tacoma listed as one of the 9 Participants purchasing a zero share will not execute a Net Billing Agreement prior to the issuance of the Notes). Under the Net Billing Agreements, each Participant will assign its share of the Project capability to Bonneville which will in turn credit the payments made to the Supply System by each Participant for its proportionate share of the Project's annual costs against the billings made by Bonneville to the Participant for power and for certain services.

The Notes are to be issued subject to the approval of legality by Wood King Dawson Love & Sabatine, New York, New York, Bond Counsel to the Supply System, and Houghton, Cluck, Coughlin & Riley, Seattle, Washington, Special Counsel to the Supply System. It is expected that the Notes in definitive form will be ready for delivery on or about February 2, 1971.

January 14, 1971

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OFFICIAL STATEMENT

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

(A Municipal Corporation and a Joint Operating Agency of the State of Washington)

$15,000,000 3.05% Nuclear Project No. 2 Revenue Notes

January 14, 1971

The purpose of this Official Statement, which includes the cover page hereof, is to set forth information concerning Washington Public Power Supply System (the "Supply System"), its Nuclear Project No. 2 (the "Project") and its $15,000,000 Nuclear Project No. 2 Revenue Notes (the "Notes"), in connection with the sale by the Supply System of the Notes and for the information of all who may become holders of such Notes. The Notes are to be issued pursuant to the Revised Code of Washington, Chapter 43.52, as amended (the "Act") and Resolution No. 537 (the "Resolution") adopted December 4, 1970 by the Supply System.

PURPOSE OF THE NOTES

The purpose of the Notes is to pay preliminary costs of the Project as more fully described herein under "The Project". The estimated preliminary costs are set forth herein under "Estimated Application of Note Proceeds".

THE SUPPLY SYSTEM

The Supply System, a municipal corporation and a joint operating agency of the State of Washington, was organized in January, 1957, pursuant to the Act. Its membership is made up of 18 of the operating public utility districts in the State and the City of Richland, Washington. The Supply System has the authority, among other things, to acquire, construct and operate plants, works and facilities for the generation and transmission of electric power and energy. The Supply System has the power of eminent domain, but it is specifically precluded from the condemnation of any plants, works or facilities owned and operated by any city, public utility district or privately-owned electric utility.

The Supply System presently owns and operates the electric generating and associated facilities on the United States Atomic Energy Commission's Hanford Reservation (the "Hanford Project") with a name plate rating of approximately 860,000 kilowatts which as of August 31, 1970 led the United States in total electric energy produced by a nuclear power plant, and the Packwood Hydroelectric Project with a name plate rating of approximately 27,500 kilowatts. In 1963, the Supply System issued $122,000,000 Hanford Project Electric Revenue Bonds, $78,145,000 of which are presently outstanding. In 1962 and 1965, the Supply System sold $10,500,000 and $3,200,000 Packwood Lake Hydroelectric Project Revenue Bonds, of which $13,186,000 are still outstanding. Both Hanford and Packwood bonds are payable solely from the revenues of the respective systems which they financed.

The Supply System has its principal office in Kennewick, Washington. The management and control of the Supply System is vested in a Board of Directors composed of representatives of the 18 member Public Utility Districts and the City of Richland. Regular meetings of the Board are held quarterly.

An Executive Committee of the Board administers the business of the Supply System between regular meetings of the Board. Members of the Executive Committee are:

Ed Fischer, Commissioner, Clark County Public Utility District, Chairman
W. G. Hulbert, Jr., Manager, Snohomish County Public Utility District
Frank Jaeger, Commissioner, Cowlitz County Public Utility District
J. J. Stein, Manager, Grays Harbor County Public Utility District
Glenn C. Walkley, Commissioner, Franklin County Public Utility District

The Executive Committee holds regular meetings each month and special meetings as often as the business of the Supply System may require.

Members of the Supply System and their respective representatives on the Board of Directors are as follows:

Public Utility District No. 1 of Benton County	Thomas E. Black
Public Utility District No. 1 of Chelan County	Kirby Billingsley
Public Utility District No. 1 of Clallam County	Alvin E. Fletcher
Public Utility District No. 1 of Clark County	Ed Fischer
Public Utility District No. 1 of Cowlitz County	Frank Jaeger
Public Utility District No. 1 of Douglas County	Howard Prey
Public Utility District No. 1 of Ferry County	Oliver R. Pooler
Public Utility District No. 1 of Franklin County	Glenn C. Walkley
Public Utility District No. 2 of Grant County	John L. Toevs
Public Utility District No. 1 of Grays Harbor County	J. J. Stein
Public Utility District No. 1 of Kittitas County	Harold W. Jenkins
Public Utility District No. 1 of Klickitat County	Gerald C. Fenton
Public Utility District No. 1 of Lewis County	T. R. Teitzel
Public Utility District No. 3 of Mason County	Edwin W. Taylor
Public Utility District No. 2 of Pacific County	E. Victor Rhodes
City of Richland	Joseph Shipman
Public Utility District No. 1 of Skamania County	Ross B. Shepeard
Public Utility District No. 1 of Snohomish County	W. G. Hulbert, Jr.
Public Utility District No. 1 of Wahkiakum County	Andrew R. Fudge

The officers of the Supply System elected by the Board are Edwin W. Taylor, President; Howard Prey, Vice President; and Alvin E. Fletcher, Secretary.

The chief administrative officer of the Supply System is Owen W. Hurd, Managing Director. The principal administrative positions of the Supply System are:

Managing Director	Owen W. Hurd
Director of Finance-Treasurer	Elmer A. Landin, Jr.
Counsel	Richard Q. Quigley
Director of Administration	R. L. Elmgren
Auditor	Paul E. Cox
Director of Information	James A. Klein
Hanford Steam Plant Superintendent	J. R. Church
Projects Engineer	S. K. Billingsley

In connection with this Project, the Supply System has engaged R. W. Beck and Associates as consulting engineer ("Consulting Engineer"), Burns & Roe, Inc. as architect-engineer ("Construction Engineer"), The S. M. Stoller Corporation as nuclear fuel consultant, and Lehman Brothers Incorporated and Lazard Frères & Co. as financial consultants.

THE PROJECT

The Project will be constructed and operated by the Supply System in accordance with an agreement (the "Project Agreement") between the Supply System and the Bonneville Power Administrator ("Bonneville"). The Project capability will be purchased under agreements (the "Net Billing Agreements") between the Supply System, Bonneville and 95 statutory preference customers of Bonneville (the "Participants"), nine of which initially will purchase a zero share. Under the Net Billing Agreements each Participant will assign its share of the Project capability to Bonneville. Payments by the Participants to the Supply System will be credited against the billings made by Bonneville to the Participants for power and certain services. The output of the Project will be added to the other power resources of Bonneville.

The Project will be located within the U.S. Atomic Energy Commission's 575 square mile Hanford Reservation on the Columbia River in Southeastern Washington north of the City of Richland. The Project will consist of a nuclear energy generating station having a name plate rating of approximately 1,100 MW complete with a nuclear steam supply system, and all other accessories and associated facilities and structures, together with all other electric facilities necessary to deliver the Project output to Bonneville's transmission system.

The plant will use cooling towers or cooling ponds for the Project's condensers, with make-up water supplied from the adjacent Columbia River.

The Hanford Reservation has been used by the Federal Government for more than 25 years for the production of weapons grade plutonium and other special nuclear materials. Currently two production reactors are in operation, one of which is the New Production Reactor which supplies steam to the Hanford Project.

The Supply System expects to adopt a Bond Resolution to provide for the permanent financing of the Project in early 1973. The Construction Engineer has estimated that the cost of construction, including the initial nuclear core, will be $321,899,000. The Consulting Engineer, assuming a single bond issue, has estimated the principal amount of the issue to be $385,100,000, at an assumed interest rate of 6%, and to be $394,500,000, at an assumed interest rate of 7%.

SECURITY FOR THE NOTES

The Net Billing Agreements referred to above provide the basic security for the financing of the Project. Interest on the Notes will be capitalized to maturity, and the Notes, together with any interest thereon, shall be payable from any moneys of the Supply System that may be lawfully applied to the payment thereof, including revenues of the Project and the proceeds of bonds or refunding notes of the Supply System.

If for any reason the Supply System is unable to issue and sell bonds or refunding notes to obtain funds to pay the principal of the Notes when due, or is unable to proceed with the financing of the Project, the Supply System covenants in the Resolution that it will terminate the Project as provided in Section 15 of the Project Agreement and will invoke the provisions of Section 10 of each of the Net Billing Agreements.

The Supply System may terminate the Project pursuant to Section 11(a) or Section 15 of the Project Agreement if it is determined that the Supply System is unable to construct, operate or proceed as owner of the Project due to licensing, financing, or operating conditions or other causes which are beyond its control.

Section 10 of the Net Billing Agreements provides that on termination of the Project each of the Participants will pay its proportionate share of the principal and of the interest, if any, due on the Notes to the Supply System together with any other costs associated with the termination of the Project. Such payments in turn would be credited against the billings made by Bonneville to the Participants for power and for certain services under Net Billing procedures as hereinafter described.

ESTIMATED APPLICATION OF NOTE PROCEEDS

The proceeds from the sale of the Notes will be applied to the payment of the estimated preliminary expenses set forth below. The Supply System estimates that these funds will be sufficient to pay all expenses necessary to obtain a construction permit for the Project from the Atomic Energy Commission and site certification from the State of Washington. The Supply System presently plans to sell all or a portion of the permanent bonds as soon as practicable after the construction permit and site certification have been obtained in late 1972 or early 1973 and fund the Notes at that time.

Estimated Disposition of Proceeds
$15,000,000 Notes

Preliminary Expenses*		$ 250,000
Construction Costs:		
Site Preparation	$1,460,000	
Nuclear Steam Supply System	1,977,000	
Architect-Engineer	5,303,000	
Preliminary Construction	1,451,000	
Total Construction Costs		10,191,000
Contingency and Escalation		1,789,000
System Direct Costs		1,300,000
Other Professional Services		300,000
Note Discount and Other Financing Expenses		525,000
Capitalized Interest		1,601,250
Gross Costs		$15,956,250
Less: Investment Earnings (estimated at 4%)		956,250
Principal Amount of Note Issue		$15,000,000

* Includes repayment of advances made to the System by the Public Power Council Foundation of the Northwest Public Power Association and reimbursement of Grays Harbor Public Utility District No. 1 and the System general fund for payment of costs relating to preliminary site investigation and other preliminary costs.

BONNEVILLE POWER ADMINISTRATION

The Bonneville Power Administration, an agency in the U. S. Department of the Interior, was established by the Bonneville Project Act of August 20, 1937. Since its establishment, Bonneville has been designated, either by Congressional Act or Secretarial Order to build transmission facilities and to market power from the 26 federal hydroelectric projects in the Pacific Northwest. These projects have an installed capacity of 9,036,000 kilowatts. Five new projects and additions at existing projects now under construction will add approximately 6,500,000 kilowatts when completed. An additional 5,300,000 kilowatts have been authorized either by way of new projects or as additions to existing projects. These projects have approximately 20,000,000 acre-feet of hydro storage in operation or under construction. Bonneville has constructed and operates more than 11,000 miles of 115 kv or higher voltage transmission lines including 1,522 miles of 500 kv ac lines and 264 miles of 800 kv dc lines.

These federal hydro projects together with Bonneville's transmission facilities are designated as the Federal Columbia River Power System. The Government's investment in the Federal Columbia River Power System as of July 1, 1970 was more than $2.8 billion.

Bonneville's revenues for the Federal Columbia River Power System for the past five fiscal years by major classifications of customers were as follows:

Revenue by Major Customer Classification (1)

Fiscal Year Ended June 30	Preference Customers	Other Electric Utilities	Industrial	Transmission Service and Other	Total
1966	48,515,869	9,262,070	31,662,201	13,727,749	103,167,889
1967	51,125,554	12,753,405	35,275,996	13,673,067	112,828,022
1968	49,134,719	12,515,810	39,498,338	16,739,045	117,887,912
1969	55,752,314	16,967,117	46,204,161	18,353,608	137,277,200
1970	58,419,581	20,319,033	50,063,203	18,878,209	147,680,026

(1) From Bonneville Summary Financial Data

In addition to the federal hydroelectric projects, Bonneville has entered into arrangements for the acquisition of additional power supply and storage. Under the Columbia Treaty between the United States and Canada and the associated Canadian Storage Power Exchange Agreements relating to the development of the Columbia River Bonneville, acting jointly with the U. S. Army Corps of Engineers as the U. S. entity, has obtained certain rights to 15,500,000 acre-feet of hydro storage on the Columbia River in Canada. The exchange agreements between Bonneville, the Supply System and 76 utility participants relating to the Hanford Nuclear Project add an additional 860,000 kilowatts to the Federal Columbia River Power System.

Bonneville also transmits over its transmission facilities the major portion of the power from 11 nonfederal projects to various private and public utilities in the Northwest.

The Federal Columbia River Power System has strong interconnections with other regions in the United States and Canada. Three high voltage transmission line interconnections (two 500 kv DC, one 800 kv DC) of the Pacific Northwest-Pacific Southwest Inter Tie lines have been completed and are in operation. Two 500 kv lines interconnect the Federal Columbia River Power System with British Columbia, Canada, and several 230 kv lines interconnect the eastern portion of the System with utilities in the Mountain States and adjacent Canadian provinces. These interconnections provide, in addition to mutual support in the event of a breakdown or emergency, the means to carry capacity and energy which is surplus to the Pacific Northwest needs to these areas, and conversely to carry surplus capacity and energy from these areas into the Pacific Northwest.

BONNEVILLE CONTRACTS

Bonneville and each of the Participants have entered into one or more contracts (the "Bonneville Contracts") which require payments by the Participants to Bonneville for the purchase or exchange of power, the operation and maintenance of facilities, or the use of transmission facilities.

Bonneville, under the terms of varying power sales contracts, markets power from the Federal Columbia River Power System to 155 customers, including 111 statutory preference utilities. Each of the Participants hereinafter described is a statutory preference customer and is a party to at least one such power sales contract. These contracts generally provide for the sale of firm power to the Participant in the amount of its requirements, delivered to the Participant's system. The Participant pays for the power at established Bonneville rate schedules.

Under the Power Sales Contracts with the Participants, Bonneville is obligated to serve the Participant's "requirements". Requirements are the amounts of power needed by the Participant over and above the generating resources, if any, that the Participant has available to serve its own loads. This obligation is effective unless Bonneville gives the Participant at least five years' notice of insufficiency of supply. At the end of the notice period Bonneville may restrict its deliveries to an amount which is not less than the amount which Bonneville will be obligated to deliver in 1975-76 or 25,000 average kilowatts, whichever is more.

Power Sales Contracts with the Participants are generally for a term of 20 years and have varying termination dates over the next 20 years. In the past Bonneville has replaced its power sales contracts with new 20-year power sales contracts prior to their expiration.

Rates applicable to Bonneville power sales contracts may be changed once each five years. The next rate adjustment date for all power sales contracts is December 20, 1974.

THE PARTICIPANTS

The Project will have 95 Participants, of which 28 are municipalities, 22 are districts and 45 are cooperatives. The municipalities will contract to purchase approximately 19.3% of the plant capability, the districts will purchase approximately 60.2% and the cooperatives, the remaining 20.5%.

Exhibit I attached hereto lists each Participant and indicates its Share of the Project capability purchased. The Idaho municipalities, shown in Exhibit I as Group I, each with an initial zero Share, will participate in the percentage shown in the last column of Exhibit I, if prior to January 1, 1978 the Attorney General of the State of Idaho shall render an opinion concurred in by the Supply System's bond counsel, affirming the legal authority of the Idaho municipalities to participate in the Project on the terms and conditions specified in the Net Billing Agreements. To provide for such Shares, the Shares of five major State of Washington Participants, shown in Exhibit I as Group II, will be reduced.

The Shares of the respective Participants may be further changed upon mutual agreement of the Participants shown as Group II or upon mutual agreement of such Group II Participants and one or more other Participants so as to reduce the Share of one or more of the Group II Participants and increase the Shares of the other agreeing Participants. However, any such change shall be made only prior to the adoption of the Bond Resolution which authorizes the issuance of Project Bonds in an amount sufficient to finance the cost of construction of the Project and only subject to the conditions set forth in Section 11C of the Resolution and herein under the caption "The Resolution", sub-caption "Particular Covenants of the System", paragraph C.

The Participants, all of whom are statutory preference customers of Bonneville, currently obtain all or part of their power supply from Bonneville, and, under their Bonneville Contracts, will have an estimated net billing capacity in excess of their share of the estimated Project's annual costs paid to the Supply System. Each Participant's share will be net billed or credited against the billings made by Bonneville to the Participant on a monthly basis under its Bonneville Contract(s).

At or prior to the delivery of the Notes, each of the Participants, other than the City of Tacoma, will have executed a Net Billing Agreement, as more fully described below, with the Supply System, and Bonneville.

In the Net Billing Agreements, each Participant assigns its share of the Project's capability to Bonneville, and the entire output of the Project will be added to and pooled with the other power sources available to Bonneville.

Since the Participants' payments to the Supply System will be net billed, the cost of the power produced by the Project will be borne by all of the Bonneville customers. Bonneville has assured Congress that "any costs or losses to Bonneville under these agreements will be borne by all Bonneville rate payers through rate adjustments, if necessary."

THE HYDRO-THERMAL PROGRAM AND POWER SUPPLY SYSTEM IN THE PACIFIC NORTHWEST

The Joint Power Planning Council consisting of 108 public and private utilities in the Pacific Northwest and Bonneville was formed to plan the coordination of existing and future thermal and hydro resources in the Northwest. The major part of the power supply for the Pacific Northwest has traditionally been from hydroelectric generating resources. However, the remaining hydro development in the Northwest will be essentially peaking generation installations. The area must turn to thermal generation for its base load resources in the immediate future. The combination of hydro peaking and large scale thermal generating plants was found by the Joint Power Planning Council to be the most economic alternative means of producing power to meet the area's anticipated load growth. The most economic thermal units are too large for any single utility to install for its own needs. As a result of these findings, the Joint Power Planning Council developed the "Hydro-Thermal Power Program". This program has been endorsed by the current and previous Administrations and by the Congress.

The utility members of the Joint Power Planning Council have concluded that the Hydro-Thermal Program will:

1. Best preserve the environment and natural beauties of the Pacific Northwest.
2. Make efficient and economic use of the Federal Columbia River Transmission System.
3. Obtain the economies of scale from large thermal generating plants.

4. Meld the large thermal generating plants with existing Northwest Hydro and the future peaking generation units which will be installed at existing dams, to achieve the most economic and reliable power supply to meet the necessary loads of the Pacific Northwest.

Historically, the first large scale steam electric generating plant to be constructed in the Pacific Northwest was the 860,000 kilowatt Hanford Project of the Supply System which was placed in commercial operation on November 29, 1966. It uses by-product steam from a dual-purpose nuclear reactor owned and operated by the Atomic Energy Commission at Hanford to produce the steam necessary to drive the generators. The second large scale steam electric generating plant in the Pacific Northwest and the first being built under the Hydro-Thermal Power Program is the Centralia Steam Plant which is sponsored by Pacific Power & Light Company and the Washington Water Power Company and is now under construction. Six additional participants, Portland General Electric Company, Puget Sound Power & Light Company, the Cities of Seattle and Tacoma and the Public Utility Districts of Grays Harbor and Snohomish Counties, have entered into construction and ownership agreements with the sponsors. The initial installation will consist of two 700,000 kilowatt steam electric generating units using coal strip-mined from a nearby coal field for fuel. The first unit is scheduled for operation in late 1971, and the second unit in late 1972.

The first single-purpose nuclear fueled electric generating plant in the Pacific Northwest, and the second plant in the present Hydro-Thermal Program is planned for construction by the Portland General Electric Company at its Trojan site on the Columbia River down stream from Portland, Oregon. The City of Eugene, Oregon and Pacific Power & Light Company will own portions of the plant. This plant of approximately 1,100,000 kilowatts is scheduled for completion in 1974. The third power installation in the Program is Pacific Power and Light Company's coal-fired units to be installed at the Jim Bridger Plant located in Rock Springs, Wyoming. The Pacific Power and Light Company's first 500,000 kilowatt generating unit is scheduled for operation in late 1975; the schedule for the second unit is now under study. The fourth installation under the Program is to be Supply System's Nuclear Project No. 2 which has heretofore been described under the caption "The Project" and which is scheduled for commercial operation in September 1977. Thereafter, it is estimated that the Pacific Northwest will require 3,000,000 kilowatts of additional thermal power by 1981. Sponsorship of the additional plants to provide this power has not yet been determined.

The present Hydro-Thermal Power Program of thermal generating plants is tabulated below as follows:

Schedule of Hydro-Thermal Power Program

Plant Number	Sponsor	Location	Type	Rated Capacity (Mw)	Date of Commercial Operation
1	Pacific Power & Light Company	Centralia	Coal-fired	700	Sept. 1971
	Washington Water Power Company	Washington	Coal-fired	700	Sept. 1972
2	Portland General Electric Company (Trojan)	Near Portland, Oregon	Nuclear	1,100	Sept. 1974
3	Pacific Power & Light Company (Jim Bridger Plant)	Rock Springs, Wyoming	Coal-fired	500	Sept. 1975
				500	*
4	Washington Public Power Supply System	Hanford, Washington	Nuclear	1,100	Sept. 1977
5	To be announced			1,100	*
6	To be announced			1,100	*
7	To be announced			1,100	*

*Date under study.

Power Requirements and Resources

The Pacific Northwest Utilities Conference Committee, the committee of Northwest utilities which had the responsibility for estimating loads and resources, in its June 23, 1970 supplement to the Long-

Range Projection of Power Loads and Resources for Thermal Planning, presented an analysis of both peak and energy loads and resources available to meet them. The resources assumed to be available are restricted to those plants (1) in operation, or (2) under construction, or (3) those for which substantial funds have been made available for final planning. The supplement included as resources the Centralia Plant, the Trojan Plant and the first Pacific Power and Light Company unit in the Jim Bridger Plant. Assuming the addition of the second Pacific Power and Light Company unit at the Jim Bridger Plant in 1976 and the Supply System plant in the resource column for the year 1977 and thereafter, the estimated resources available to meet projected loads in terms of dependable capacity and firm energy are summarized in the following tables.

Firm Loads and Resources

Northwest Power Pool, West Group Area*

Peak Capability—Kilowatts

Year Ending June 30	Estimated Requirements	Estimated Resources (1)	Additional Resources Required (2)	WPPSS Plant	Balance Of Resources Required (2)
1971	19,216,000	19,082,000	134,000	—	134,100
1972	20,079,000	20,501,000	(422,000)	—	(422,000)
1973	21,704,000	20,963,000	741,000	—	741,000
1974	23,042,000	22,477,000	565,000	—	565,000
1975	24,422,000	24,570,000	(148,000)	—	(148,000)
1976	25,192,000	25,878,000	(686,000)	—	(686,000)
1977	26,508,000	26,755,000	(247,000)	—	(247,000)
1978	27,919,000	27,642,000	277,000	935,000(3)	(658,000)
1979	29,398,000	27,564,000	1,834,000	935,000(3)	899,000
1980	31,030,000	28,160,000	2,870,000	935,000(3)	1,935,000
1981	32,801,000	29,288,000	3,513,000	935,000(3)	2,578,000

Energy Capability—Average Kilowatts

1971	12,004,000	11,839,000	165,000	—	165,000
1972	12,322,000	12,521,000	(199,000)	—	(199,000)
1973	13,441,000	13,630,000	(189,000)	—	(189,000)
1974	14,356,000	14,304,000	52,000	—	52,000
1975	15,152,000	14,989,000	163,000	—	163,000
1976	15,401,000	15,760,000	(359,000)	—	(359,000)
1977	16,121,000	16,253,000	(132,000)	—	(132,000)
1978	16,878,000	16,265,000	613,000	787,000	(174,000)
1979	17,767,000	16,254,000	1,513,000	947,000	566,000
1980	18,749,000	16,240,000	2,509,000	947,000	1,562,000
1981	19,744,000	16,224,000	3,520,000	947,000	2,573,000

(1) Assuming the addition of Pacific Power and Light Company's second unit at Jim Bridger Plant in 1976.

(2) Parenthesis denotes surplus.

(3) After deducting 15% peaking reserves.

*Area served by the utility members of the Joint Power Planning Council.

THE NET BILLING AGREEMENTS

The Supply System, Bonneville and each Participant, except the City of Tacoma, have entered into a Net Billing Agreement. These Agreements provide for the assignment to Bonneville of the capability of the Project by the Participants. The Participants pay the Supply System all costs associated with the Project. In consideration of such assignment Bonneville will offset or credit the amounts paid by the Participants to the Supply System against amounts owed Bonneville by the Participants for power purchased and certain services under Bonneville Contracts. This system of offsets or credits is termed "net billing". A summary of certain provisions of the Net Billing Agreements follows; reference should be made to full text of the form of Agreements attached hereto as Exhibit III.

The capitalization of any word or words which is not conventionally capitalized (e.g. Project, Participants) indicates that such words are defined in the Net Billing Agreements (Exhibit III). (The same practice is followed in the summaries of the Project Agreement and Resolution which follow.)

Term of the Agreement

Each Agreement became effective upon execution and delivery and will terminate on the date that the Project Agreement terminates except as provided in Section 10(c) as to accrued obligations and liabilities. Net billing will begin on January 1, 1977, or the date of commercial operation, whichever is earlier, or at some earlier date if the Project is terminated pursuant to Section 15 of the Project Agreement, as hereinafter described.

Although the Net Billing Agreements may be terminated prior to the maturity of any Notes or Bonds, the obligation of each of the Participants thereunder to pay its proportionate share of debt service on any Notes or Bonds shall continue until the Notes or Bonds have been retired, and Bonneville will continue to be obligated to offset or credit these payments against the Participant's Bonneville Contracts.

Ownership and Operation

The Supply System will use its best efforts to arrange for the financing, design, and construction of the Project, and will own, operate and maintain it after completion.

Sale, Purchase and Assignment

The Supply System will sell and each Participant will purchase its share of the Project Capability and in turn will assign its share of such Capability to Bonneville.

Method of Sale and Purchase

The Supply System sells and each Participant purchases its share of the Project Capability as shown in Exhibit A attached to the Net Billing Agreements. The purchase price to be paid by each Participant in each Contract Year will be the amount so specified in the Billing Statement rendered to the Participant by the Supply System. The Participant is obligated to pay the Supply System whether or not the Project is completed, operable, or operating and notwithstanding the suspension, interruption, interference, reduction or curtailment of the Project output, and such payments shall not be subject to reduction and shall not be conditioned upon the performance or nonperformance by the Supply System or Bonneville or any other Participant under the Net Billing Agreements or any other agreement or instrument.

Assignment

The Participant assigns and Bonneville accepts the assignment of the Participant's Share. In consideration of such assignment, Bonneville will offset or credit the amounts paid by the Participant to the Supply System under the Net Billing Agreement against amounts owed Bonneville for power purchased and certain services under its Bonneville Contracts.

Bonneville is obligated to make the offsets and credits specified in the Net Billing Agreements whether or not the Project is completed, operable, or operating and notwithstanding the suspension, interruption, interference, reduction or curtailment of the Project output. Such offsets and credits shall not be subject to reduction and shall not be conditioned upon the performance or nonperformance by the

Supply System or Bonneville or any other Participant under the Net Billing Agreements or any other agreement or instrument.

Payment

Each Participant is obligated to pay the Supply System its fractional share of the Supply System's expenses incurred in connection with the operation of the Project on a monthly basis each year. Each month's payments will be based on the amount of net billing credit received by the Participant during the preceding month on its Bonneville billings. If the credits received from Bonneville do not cover a Participant's share of expenses for a contract year, any amounts remaining unpaid will be made up by the Participant.

Under the Hydro Thermal Program, Bonneville may enter into net billing agreements with any or all of the Participants in connection with the construction and operation of other thermal generating plants. Pursuant to the Net Billing Agreements, Bonneville will offset the amounts it owes under the Net Billing Agreements and all other net billing agreements which it may have in effect with each Participant against the sum of the amounts that such Participant may owe Bonneville for power and certain services. Each Net Billing Agreement provides that Bonneville and the Participant shall not enter into any agreements providing for payments to the Participant which Bonneville estimates will cause the aggregate of its billings to the Participant to be less than 115 percent of the Bonneville net billing obligations to the Participant under all agreements providing for net billing.

If Bonneville is unable to net bill the amounts to be paid to the Supply System because the dollar obligations due Bonneville from a Participant are or are expected to be insufficient to offset Bonneville's dollar obligations to such Participant, Bonneville will endeavor to arrange for a voluntary assignment of such amounts which cannot be net billed and the Participant shall make any such assignment so arranged. However, the other Participants will have the first right to accept such assignment, pro rata among those If Bonneville is unable to arrange for such an assignment, the Participant will make such assignment to the other Participants, who are obligated to accept it, pro rata, provided that the sum of such assignments to a Participant shall not exceed 25% of the Participant's Share of Project Capability without its consent. exercising such right before such an assignment is made to a customer who is not one of the Participants.

Nevertheless, if all or a portion of the Participant's Share is assigned as described above, the Participant will remain liable to pay the purchase price for its Share in accordance with its Agreement as if such assignment had not been made. Such liability of the Participant will be discharged only to the extent that the assignee of all or a portion of the Participant's Share shall pay to the Supply System the purchase price for the Share so assigned.

If assignments cannot be made in amounts sufficient to bring into balance the respective dollar obligation of Bonneville and an accumulated balance in favor of the Participant from a previous year is expected by Bonneville to be carried for an additional year, such balance and any subsequent monthly net balances that cannot be net billed will be paid in cash to the Participant by Bonneville, subject to the availability of federal appropriations for such purpose.

If Bonneville is unable to satisfy its obligation to an affected Participant by net billing, assignment or cash payment and determines that this will continue for a significant period, the affected Participant may direct that all or a portion of the power associated with its share be delivered by the Supply System for the Participant's account at a specified point of delivery either for the expected period of such inability or the remainder of the life of the Project whichever is specified by the Participant when it elects to have such energy delivered to it. The amount of power delivered will be limited to the amount of the Participant's share for which payment cannot be made.

Termination

If the Project is ended pursuant to Section 15 of the Project Agreement, as described below, Supply System will give notice of termination of each Net Billing Agreement effective upon the date of termination of the Project Agreement. Supply System shall then terminate all activities relating to construction and operation of the Project and shall undertake the salvage and disposition or sale of the Project as provided in the Project Agreement. After such termination, the Supply System will make monthly accounting statements to Bonneville and each Participant of all costs associated with such termination. The monthly accounting statements will credit against such costs all amounts received by the Supply System from the disposition of Project assets. If the monthly accounting statements show that such costs exceed such credits, the Participant will pay its portion of Project costs to the Supply System. The payments will be made at times and in amounts sufficient to discharge on a current basis the Participant's share of the amount which the Supply System is required to pay under the Resolution or the Bond Resolution for debt service and all other purposes.

Event of Default

The Participant's share of the Project Capability purchased by the Participant from the Supply System and assigned to Bonneville under the Agreement will be automatically increased for the remaining term of the Agreement pro rata with that of other nondefaulting Participants if, and to the extent that one or more of the Participants is unable, fails, or refuses for any reason to perform its obligations under its Net Billing Agreement; provided however, that the sum of such increases for each Participant, without its consent, may not exceed an accumulated maximum of 25% of each Participant's share nor shall any such increase cause the estimate of the payments to be made by the Participant to the Supply System to exceed the estimate of Bonneville's billings to the Participant for power and certain services during the period of such increase.

Participant's Rate Covenant

Any Participant will not be required to make payments to the Supply System under its Net Billing Agreement except from revenues derived from the ownership and operation of its electric utility properties and from payments by Bonneville under such Agreement. The Participant covenants that it will establish, maintain and collect rates or charges for power and energy and other services, facilities and commodities sold, furnished or supplied by it through any of its electric utility properties which shall be adequate to provide revenues sufficient to enable the Participant to make the payments to Supply System pursuant to its Net Billing Agreement and to pay all other charges and obligations payable from or constituting a charge and lien upon such revenues.

Exhibits

The Exhibits described below are an integral part of the Net Billing Agreements and are attached to the form of Net Billing Agreement appended to this Official Statement as Exhibit III.

Exhibit A — A list of the Participants and their respective shares of the Project's capability.

Exhibit B — Description of the Project.

Exhibit C — Contractual provision required by Statute or Executive Order. Under the provisions of Executive Order 11246 of September 24, 1965 and the Rules and Regulations and relevant Orders of the Secretary of Labor thereunder, the Supply System applied for a limited exemption from the cancellation, termination, and suspension provisions contained in Section 3(f) of Exhibit C to the Net Billing Agreements in the event of non-compliance with the Equal Opportunity clause contained in said Agreements, and such limited exemption was granted by the Director, Office of Federal Contract Compliance, U. S. Department of Labor.

THE PROJECT AGREEMENT

The Supply System and Bonneville have entered into the Project Agreement. That Agreement, among other things, provides standards for the design, licensing, financing, construction, fueling, operation and maintenance of the Project, and for the making of any replacements, repairs or capital additions thereto. An abbreviated summary of some of the provisions of the Project Agreement follows; however, reference should be made to the full text of the Agreement attached hereto as Exhibit IV.

Term

The Agreement was effective upon its execution and delivery and will terminate when the Project is terminated as provided in Section 15 of the Agreement.

Section 15 provides that the Project shall terminate and the Supply System shall cause the Project to be salvaged, discontinued, decommissioned, and disposed of or sold in whole or in part to the highest bidder or bidders, or disposed of in such other manner as the parties may agree when:

(a) Supply System determines it is unable to construct, operate, or proceed as owner of the Project due to licensing, financing, or operating conditions or other causes which are beyond its control.

(b) The parties determine the Project is not capable of producing energy consistent with Prudent Utility Practice or, if the parties disagree, the Project Consultant so determines, or

(c) Bonneville directs the end of Project pursuant to the provisions of Section 11(a), which provides that if the estimated cost of a replacement or repair or capital addition required by a governmental agency exceeds 20 percent of the then depreciated value of the Project Bonneville may direct that the Supply System end the Project in accordance with Section 15.

Design, Licensing and Construction of the Project

The Supply System agrees among other things (i) to perform its duties and exercise its rights in accordance with prudent utility practice; (ii) to use its best efforts to obtain all licenses, permits and other rights and regulatory approvals necessary for the ownership, construction, and operation of the Project; (iii) to construct the Project in accordance with prudent utility practice; and (iv) to use its best efforts to schedule the date of commercial operation as near as possible to September 1, 1977.

Bonneville agrees to use its best efforts to construct, operate and maintain the necessary facilities to interconnect the Project with the Government's transmission grid so as to be ready to receive the Project's generation on or before the initial test and operation of the Project.

In the Agreement "Prudent Utility Practice" at a particular time means any of the practices, methods, and acts engaged in or approved by a significant proportion of the electrical utility industry prior to such time, or any of the practices, methods, and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at the lowest reasonable cost consistent with reliability, safety and expedition. In evaluating whether any act or proposal conforms to Prudent Utility Practice, Bonneville and the Supply System and any Project Consultant shall take into account the objective to integrate the entire Project Capability with the hydroelectric resources of the Federal Columbia River Power System and to achieve optimum utilization of the resources of that system taken as a whole, and to achieve efficient and economical operation of that system.

Financing

The Supply System shall use its best efforts to issue and sell Project Bonds to finance the cost of the Project and the completion thereof, as such costs are defined in the Project Bond Resolution, and to finance the cost of any capital additions, renewals, repairs, replacements or modifications to the Project; provided, however, that such Project Bonds may then be legally issued and sold.

Prior to its adoption, the Project Bond Resolution shall be subject to the approval of Bonneville.

Budget

Both the construction budgets and the annual budgets and any revision thereof are to be submitted to Bonneville and are subject to its approval. In the absence of any objection by Bonneville such approval will be automatic after 30 days for the construction and annual budgets and after 7 days for any revision thereof.

All accounts shall be kept so as to permit conversion to the system of accounts prescribed for electric utilties by the Federal Power Commission.

Operation and Maintenance

The Supply System shall operate and maintain the Project in accordance with Prudent Utility Practice and in accordance with the requirements of the Atomic Energy Commission and other government agencies having jurisdiction.

Exhibits

The Exhibits described below are an integral part of the Project Agreement and are attached to the copy of the Project Agreement appended to this Official Statement as Exhibit IV.

Exhibit A—Description of the Project

Exhibit B—Contractual provisions required by Statute or Executive Order. Under the provisions of Executive Order 11246 of September 24, 1965 and the Rules and Regulations and relevant Orders of the Secretary of Labor thereunder, the Supply System applied for a limited exemption from the cancellation, termination, and suspension provisions contained in Section 3(f) of Exhibit B to the Project Agreement in the event of non-compliance with the Equal Opportunity clause contained in said Agreement, and such limited exemption was granted by the Director, Office of Federal Contract Compliance, U. S. Department of Labor.

THE RESOLUTION

The following is a summary of certain provisions of Resolution No. 537 authorizing the issuance of the Notes and does not purport to be complete. Reference should be made to the Resolution for full and complete information about the Notes. Copies of the Resolution are available on request either at the office of the Supply System in Kennewick, Washington, or Lehman Brothers Incorporated, One William Street, New York, New York 10004 or Lazard Frères & Co., 44 Wall Street, New York, New York 10005.

Use of the Proceeds

The Resolution authorizes the issuance of Fifteen Million Dollars ($15,000,000) principal amount of revenue notes of the System designated "Washington Public Power Supply System Nuclear Project No. 2 Revenue Notes" for the purpose of paying a part of the cost of acquiring and constructing the Project and placing it into operation, including the cost of acquiring land and rights in land, preliminary work and expenses incurred in connection with the Project, engineering and other professional services, making certain permissible site and other studies and surveys for the Project, obtaining necessary permits, licenses and approvals, preparing detailed plans and specifications for the construction of the Project, the expenses of issuing and selling the Notes and the fees and charges of the paying agents, trustees and depositaries appointed pursuant to the Resolution, and paying interest on the Notes from their date to the date of maturity thereof.

Description of the Notes

The Notes are to be issued in the form of coupon notes in the denomination of $25,000 and any multiples of $5,000 greater than $25,000 (as may be requested by the purchaser or purchasers), numbered from 1 upwards, and dated January 1, 1971. They will bear interest at such rate or rates as determined by the Board at the time of the sale thereof, will be payable as to interest on July 1, 1971 and semi-annually on each January 1 and July 1 thereafter, and shall mature on July 1, 1974.

The Notes will be subject to redemption at the option of the Supply System, prior to maturity on and after July 1, 1973, only as a whole, at any time upon payment of the principal amount thereof together with accrued interest to the date fixed for redemption.

In the event the Supply System should exercise its option to redeem the Notes, notice of such redemption will be given by the Supply System by publication of a notice at least once in daily financial papers, or daily newspapers of general circulation printed in the English language and published in the cities of Seattle, Washington, and New York, New York, such publication to be made not less than fifteen nor more than thirty days prior to the date fixed for redemption.

Sources from Which Notes Payable

The Notes, together with the interest thereon, will be payable from any monies of the Supply System that may be lawfully applied to the payment thereof, including revenues of the Project and the proceeds of the Supply System's revenue bonds or refunding notes.

Creation of Funds and Accounts

The Resolution authorizes the creation of two special funds of the Supply System: one, known as the "Preliminary Construction Fund", will be held in trust and administered by the Supply System, and the other, known as the "Note Interest Fund", will be held in trust and administered by the Note Interest Fund Trustee. The Supply System will appoint one of the Paying Agents for the Notes as Note Interest Fund Trustee.

Disposition of the Proceeds of the Notes

From the proceeds of the sale of the Notes there shall be deposited:

1. With the Note Interest Fund Trustee for credit to the Note Interest Fund an amount equal to the interest to accrue on the Notes from the date thereof to July 1, 1974, which shall be used to pay interest on the Notes during such period.

2. With the Supply System for credit to the Preliminary Construction Fund the balance of such Note proceeds, which will be applied for the purposes noted above under the title "Use of the Proceeds".

Monies in the Note Interest Fund will be used solely for the purpose of paying interest on the Notes. On or before the twenty-seventh (27th) day of the month next preceding the date upon which an installment of interest falls due on the Notes, the Note Interest Fund Trustee will transfer from the Note Interest Fund to the Paying Agents an amount which, together with any monies theretofore received or held by the Paying Agents for the purpose, will be sufficient to pay the installment of interest then falling due on the Notes. If at any time monies in the Note Interest Fund and other available monies are inadequate for payment of interest, the Supply System will transfer from the Preliminary Construction Fund to the Note Interest Fund any additional amounts of money required.

All monies held or set aside by the Supply System in the Preliminary Construction Fund will, until invested or applied as provided in the Resolution, be deposited by the Supply System for the account of the Preliminary Construction Fund in such depositary or depositaries (hereinafter referred to as the "Construction Fund Depositary" or "Construction Fund Depositaries") as the Supply System may appoint. Each Construction Fund Depositary will be a state bank or trust company or national banking association located in the State of Washington and qualified under the laws of said State to receive deposits of public monies, having a capital stock and surplus in excess of seven million five hundred thousand dollars ($7,500,000). All monies so deposited shall be continuously secured for the benefit of the Supply System and the holders of the Notes to the extent permitted by applicable state or federal laws for the securing of deposits of public monies.

Investment of Monies Held in Funds

Monies held for the credit of the Preliminary Construction Fund and the Note Interest Fund are to be invested by the Construction Fund Depositaries and the Note Interest Trustee at the direction of the Supply System, in the following:

(i) direct obligations of, or obligations on which the principal and interest are unconditionally guaranteed by the United States of America;

(ii) obligations of the Federal National Mortgage Association and obligations issued or guaranteed by the Government National Mortgage Association;

(iii) obligations issued by the Banks for Cooperatives, Federal Intermediate Credit Banks, Federal Home Loan Banks, the Export-Import Bank of the United States, and Federal Land Banks;

(iv) Public Housing Bonds or Project Notes issued by public housing authorities and fully secured as to the payment of both principal and interest by a pledge of annual contributions to be paid by the United States of America, or any agency thereof.

Monies in the Preliminary Construction Fund may be invested by the Construction Fund Depositaries, at the direction of the Supply System, in bank time deposits evidenced by certificates of deposit issued by any bank, trust company, or national banking association located in the State of Washington which is a member of the Federal Reserve System and which has capital stock and surplus of at least $7,500,000. Such time deposits will mature not later than the time when the funds invested are required for the purpose intended and will be secured at all times in the manner provided by the laws of the State of Washington, provided, that the funds invested in bank time deposits issued by any one bank, trust company, or national banking association will not exceed at any one time 50% of the total of the capital stock and surplus of such bank, trust company or national banking association.

All interest earned by reason of investment of monies in either fund shall accrue to the Preliminary Construction Fund. In the event monies that are invested are needed in the Preliminary Construction Fund or Note Interest Fund to meet obligations for which funds are not otherwise available, then the Supply System shall sell or present for redemption any part of the investments to the extent required to provide the necessary funds.

Particular Covenants of the System

According to other provisions of the Resolution the Supply System covenants and agrees with the purchasers and holders of the Notes as follows:

A. The Supply System will pay the principal of and interest on each and every Note issued by the Supply System pursuant to the Resolution on the dates and at the places provided for in the Notes from any monies of the Supply System that may be lawfully applied to the payment thereof, including revenues of the Project and the proceeds of revenue bonds or refunding notes of the Supply System.

B. So long as any of the Notes issued pursuant to the provisions of the Resolution are outstanding and unpaid, the Supply System will not, except as provided in the following Paragraph C (1) voluntarily consent to or permit any rescission of, nor will it consent to any amendment to, nor otherwise take any action under or in connection with any of the Net Billing Agreements which will reduce the payments provided for therein or which will release any party thereto from its obligations therein, or which will in any manner impair or adversely affect the rights of the Supply System or of the Noteholders, and the Supply System will perform all of its obligations under the Net Billings Agreements and take such action and proceedings as shall be necessary to protect and safeguard the security for the payment of the Notes afforded by the provisions of the Net Billing Agreements; or (ii) voluntarily consent to or permit any rescission of, nor will it consent to any amendment to or modification of, nor otherwise take any action under or in connection with the Project Agreement which will in any manner impair or adversely affect the rights of the Supply System or of the holders from time to time of the Notes. The Supply System will perform all of its obligations under the Project Agreement and will take such actions and proceedings as shall be necessary to protect and safeguard the security for the payment of the Notes afforded by the provisions of the Project Agreement.

C. Before the Supply System shall substitute any amended Exhibit A to the Net Billing Agreements as provided in the last paragraph of Exhibit A, there shall be delivered to the Board of Directors of the Supply System:

(1) A certificate of a consulting engineer or engineering firm of national reputation, knowledgeable in advising on the operation of generating facilities and the marketing of power therefrom, stating that, in its opinion, the amount of increase in the Participant's Share of each Participant whose Participant's Share is increased pursuant to any such amended Exhibit A

can be accepted by such Participant without directly increasing such Participant's total costs of purchased power; and

(2) The opinion of bond counsel to the Supply System that any change in any Participant's Share specified in such amended Exhibit A has been duly authorized by each of the Participants whose Participant's Share has been changed by such amended Exhibit A, and that the Net Billing Agreement of each such Participant, as so amended, is valid and enforceable in accordance with its terms.

D. The Supply System will proceed, as promptly as is reasonably possible and practicable to obtain all necessary permits, licenses and approvals, to prepare detailed plans and specifications for the construction of the Project and to do other necessary preliminary work so that the construction of the Project can be commenced and financing of such construction provided for through the sale of revenue bonds of the Supply System.

E. As soon as it is reasonably practicable the Supply System will issue and sell its revenue bonds or refunding notes for the purpose of providing funds to pay the cost of construction of the Project, which cost shall include, among other things, the payment of the principal and interest not paid from the principal of the Notes authorized pursuant to the Resolution. If for any reason the Supply System is unable to issue and sell bonds or refunding notes to obtain funds to pay the principal of the Notes when due, or is unable to proceed with the financing of the Project for any reason, the Supply System will terminate the Project as provided in sub-paragraph (a) of Section 15 of the Project Agreement and will invoke the provisions of Section 10 of each of the Net Billing Agreements.

Severability

If any one or more provisions of the Resolution shall be declared by any court of competent jurisdiction to be contrary to law, then the affected provisions shall be deemed separable from, and shall in no way affect the validity of, any of the other provisions of the Resolution or the Notes issued thereunder.

REGISTRATION OF THE NOTES BY STATE AUDITOR

The Notes will be registered by the State Auditor of the State of Washington, and a certificate of such registration signed by the State Auditor or a Deputy State Auditor will be endorsed upon each Note in accordance with the provisions of Section 54.24.070 of the Revised Code of Washington, made applicable to the System by the Revised Code of Washington, Section 43.52.3411. Such section provides, in part, that any revenue obligations after having been so registered and bearing such certificate, shall be held in every action, suit, or proceeding in which their validity is or may be brought into question prima facie valid and binding obligations in accordance with their terms.

TRUSTEE

The Supply System has appointed Marine Midland Bank-New York to serve as the Note Interest Fund Trustee.

NEGOTIABLE INSTRUMENTS

The Notes and interest coupons attached hereto are negotiable instruments in accordance with the provisions of Section 54.24.120 of the Revised Code of Washington.

LITIGATION

There is no litigation pending, nor to the knowledge of the Supply System, any threatened, questioning the corporate existence of the Supply System, or the title of the officers of the Supply System to their respective offices, or the validity of the Notes, or the power and authority of the Supply System to issue the Notes, or the validity of the Net Billing Agreements, or the validity of the Project Agreement, or the validity of any other proceeding taken or contract entered into by the Supply System, which is in any way related to the Project, or the power and authority of the Supply System to fix, charge and collect rates for the sale of power, energy and capability from the Project as provided in the Resolution.

APPROVAL OF LEGAL PROCEEDINGS

All legal matters incident to the Net Billing Agreements, the Project Agreement and the authorization and issuance of the Notes are subject to the approval of Messrs. Wood King Dawson Love & Sabatine, Bond Counsel to the Supply System, and Messrs. Houghton, Cluck, Coughlin & Riley, Special Counsel to the Supply System. Copies of the opinions they propose to render are appended hereto as Exhibits V and VI.

TAX EXEMPTION

In the opinion of the above named Counsel, the interest on the Notes will be exempt from Federal income taxes under existing laws, regulations, and a specific ruling issued by the Internal Revenue Service, dated November 18, 1970.

MISCELLANEOUS

The references, excerpts, and summaries contained herein of the Net Billing Agreements executed between the Supply System, the Participants and Bonneville, the Project Agreement between Bonneville and the Supply System, and the Resolution, do not purport to be complete statements of the provisions of such documents and reference should be made to such documents for a full and complete statement of all matters relating to the Notes, the basic agreements securing the Notes and the rights and obligations of the holders thereof.

Copies of the Resolution are available on request either at the office of the Supply System in Kennewick, Washington, Lehman Brothers Incorporated, One William Street, New York, New York 10004, or Lazard Frères & Co., 44 Wall Street, New York, New York 10005.

The authorizations, agreements and covenants of the Supply System are set forth in the Resolution, and neither this Official Statement nor any advertisement of the Notes are to be construed as a contract with the holders of the Notes. Any statements made in this Official Statement involving matters of opinion or of estimates, whether or not expressly so identified, are intended merely as such and not as representations of fact.

All of the information relative to the Pacific Northwest, Bonneville, Joint Power Planning Council and Pacific Northwest Utilities Conference Committee, have been taken from sources deemed to be reliable but are not guaranteed as to completeness or accuracy.

The delivery of this Official Statement has been duly authorized by the Supply System.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

By /s/ A. E. FLETCHER
Secretary

Dated January 14, 1971

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EXHIBIT I

The Participants, their customers and gross revenues, Estimated Bonneville Billings for power and certain services and Participant's Shares

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Nuclear Project No. 2

Columns (1) and (2) in the following table show the number of customers and the gross revenues of each Participant for fiscal 1969.

Column (3) shows the amount of the billings for power and certain services, after deducting any amounts previously committed under other net billing or exchange agreements, that Bonneville estimates each Participant will be obligated to pay in the year 1978-1979, the first full year of commercial operation of the Project.

Based upon an annual cost of $43,152,000 and $46,921,000, at a 6% and 7% rate, respectively, on the permanent financing, Columns (4) and (5) show the annual Project costs as they are allocated to each Participant to be offset or credited against the billings to the Participant shown in Column (3).

Column (6) shows the percentages of the Project's capability that has initially been purchased by the Participant and assigned to Bonneville.

Column (7) shows the percentages for Groups I and II, if prior to January 1, 1978, the Attorney General of the State of Idaho shall render an opinion, concurred in by the Supply System's Bond Counsel, affirming the legal authority of the Participants in Group I below, who initially will have a zero participation, to participate in the Project on the terms and conditions specified in the Net Billing Agreements. A new Exhibit A to the Net Billing Agreements will be prepared by the Supply System and shall be substituted for Exhibit A to each Net Billing Agreement specifying the Participant's Share in the amount shown below in Column (7) for each of the Participants noted as Group I and II.

Participant	(1) Fiscal 1969 Statistics Customers	(2) Fiscal 1969 Statistics Revenues
City of Albion, Idaho	151	$ 25,017
City of Bandon, Oregon	1,461	302,236
Public Utility District No. 1 of Benton County, Washington	13,700	3,861,617
Benton Rural Electric Association, Inc.	4,442	1,021,718
Big Bend Electric Cooperative, Inc.	3,922	1,527,334
Blachly-Lane County Cooperative Electric Association	1,559	556,241
City of Blaine, Washingon	936	174,515
City of Bonners Ferry, Idaho	1,493	277,425
City of Burley, Idaho	3,215	723,460
City of Canby, Oregon	1,586	287,097
City of Cascade Locks, Oregon	588	129,324
Central Electric Cooperative, Inc.	3,328	811,741
City of Centralia, Washington	5,881	1,002,090
Central Lincoln Peoples' Utility District	15,352	4,917,227
City of Cheney, Washington	2,002	457,811
Public Utility District No. 1 of Clallam County, Washington	8,870	1,991,782
Public Utility District No. 1 of Clark County, Washington	45,342	10,927,234
Clatskanie Peoples Utility District	2,134	1,700,670
Clearwater Power Company	4,969	1,120,932
Columbia Basin Electric Cooperative, Inc.	2,855	811,514
Columbia Power Cooperative Association, Inc.	1,190	382,330
Columbia Rural Electric Association, Inc.	1,746	615,309
Consumers Power, Inc.	7,377	1,970,534
Coos-Curry Electric Cooperative, Inc.	7,005	1,833,688
City of Coulee Dam, Washington	492	131,156
Public Utility District No. 1 of Cowlitz County, Washington	26,886	8,082[illegible]
City of Declo, Idaho	83	15,4[illegible]
Douglas Electric Cooperative, Inc.	4,291	845,927
City of Drain, Oregon	514	158,207
East End Mutual Electric Co., Ltd.	268	40,528
City of Ellensburg, Washington	4,838	938,738
Fall River Rural Electric Cooperative, Inc.	3,470	697,094
Farmers Electric Co., Ltd.	158	14,831
Public Utility District No. 1 of Ferry County, Washington	1,395	388,267
Flathead Electric Cooperative, Inc.	3,271	627,090
City of Forest Grove, Oregon	3,716	742,781
Public Utility District No. 1 of Franklin County, Washington	9,312	2,483,802
Public Utility District No. 1 of Grays Harbor County, Washington	26,810	5,361,893
Harney Electric Cooperative, Inc.	1,339	831,622
City of Heyburn, Idaho	516	351,331
Hood River Electric Cooperative of Hood River County, Oregon	1,800	483,507
Idaho County Light & Power Cooperative Association, Inc.	1,438	300,618
City of Idaho Falls, Idaho	12,226	2,714,674
Inland Power & Light Company	10,066	2,113,305
Public Utility District No. 1 of Kittitas County, Washington	929	216,678
Public Utility District No. 1 of Klickitat County, Washington	5,285	1,278,939
Kootenai Electric Cooperative, Inc.	3,563	630,429
Lane County Electric Cooperative, Inc.	6,613	1,558,378
Public Utility District No. 1 of Lewis County, Washington	13,697	2,802,066
Lincoln Electric Cooperative, Inc. (Montana)	1,741	489,862

(A) Based upon current Bonneville rate schedules. The next rate adjustment date for all power sales contracts is December 20, 1974.
(B) Based upon average annual costs; costs could be lower in early years.
* Group I Participants.
† Group II Participants.

(3) Anticipated Bonneville Billings 1978-1979(A)	(4) ESTIMATED Participant's Share of Annual Costs of Nuclear Project No. 2 1978-1979(B) 6%	(5) 7%	(6) Participant's Share of Project Capability Initial Share	(7) Adjusted Share for Group I and II
$ 8,100	—	—	00.000	00.016*
140,900	$ 113,500	$ 123,400	00.263	
3,047,300	2,308,600	2,510,300	05.350	
340,300	287,400	312,500	00.666	
883,500	694,700	755,400	01.610	
176,400	117,400	127,600	00.272	
96,500	79,800	86,800	00.185	
94,600	—	—	00.000	00.182*
372,500	—	—	00.000	00.694*
131,200	38,800	42,200	00.090	
31,300	23,300	25,300	00.054	
306,300	252,900	275,000	00.586	
389,200	318,900	346,700	00.739	
2,187,600	1,733,400	1,884,800	04.017	
284,100	232,600	252,900	00.539	
943,800	763,400	830,000	01.769	
6,045,700	2,949,000	3,206,600	06.834	06.151†
1,298,800	861,300	936,500	01.996	
405,500	334,400	363,600	00.775	
347,100	290,400	315,800	00.673	
74,800	61,700	67,100	00.143	
389,600	328,400	357,100	00.761	
331,800	195,500	212,600	00.453	
893,700	705,100	766,700	01.634	
67,500	59,100	64,300	00.137	
6,900,000	2,649,100	2,880,500	06.139	05.525†
9,500	—	—	00.000	00.019*
472,900	156,600	170,300	00.363	
114,700	94,100	102,300	00.218	
16,800	14,200	15,500	00.033	
541,900	443,600	482,300	01.028	
214,800	176,500	191,900	00.409	
22,700	17,700	19,200	00.041	
88,800	73,800	80,200	00.171	
196,700	159,700	173,600	00.370	
129,100	78,100	84,900	00.181	
1,333,400	1,022,700	1,112,000	02.370	
3,263,700	1,474,500	1,603,300	03.417	03.075†
375,200	310,300	337,400	00.719	
260,600	—	—	00.000	00.504*
263,700	216,600	235,500	00.502	
96,900	80,300	87,300	00.186	
1,255,100	—	—	00.000	02.376*
619,400	527,300	573,400	01.222	
114,700	94,900	103,200	00.220	
568,100	435,400	473,400	01.009	
206,200	168,700	183,500	00.391	
816,400	626,600	681,300	01.452	
1,194,900	981,300	1,067,000	02.274	
127,800	110,100	119,600	00.255	

Participant	(1) Fiscal 1969 Statistics: Customers	(2) Revenues
Lost River Electric Cooperative, Inc.	1,180	$ 237,508
Lower Valley Power & Light, Inc.	5,264	1,277,68
Public Utility District No. 1 of Mason County, Washington	1,937	319,04
Public Utility District No. 3 of Mason County, Washington	10,533	1,864,15
Town of McCleary, Washington	552	179,30
City of McMinnville, Oregon	4,879	1,113,02
Midstate Electric Cooperative, Inc.	2,501	622,25
City of Milton-Freewater, Oregon	3,245	582,33
City of Minidoka, Idaho	51	8,48
Missoula Electric Cooperative, Inc.	2,770	556,13
City of Monmouth, Oregon	1,641	321,97
Nespelem Valley Electric Cooperative, Inc.	851	216,16
Northern Lights, Inc.	4,836	903,78
Northern Wasco County People's Utility District	2,267	439,59
Okanogan County Electric Cooperative, Inc.	760	152,95
Public Utility District No. 1 of Okanogan County, Washington	9,865	2,372,52
Orcas Power and Light Company	2,571	691,27
Public Utility District No. 2 of Pacific County, Washington	9,433	1,514,44
City of Port Angeles, Washington	6,289	1,728,97
Prairie Power Cooperative, Inc.	267	62,42
Raft River Rural Electric Cooperative, Inc.	1,579	877,89
Ravalli County Electric Cooperative, Inc.	1,580	407,19
City of Richland, Washington	8,523	2,215,1
Riverside Electric Company, Ltd.	185	24
City of Rupert, Idaho	1,861	404,
Rural Electric Company	1,636	325,54
Salem Electric	5,772	1,049,01
Salmon River Electric Cooperative, Inc.	1,002	264,1
City of Seattle, Washington	258,558	53,113,1
Public Utility District No. 1 of Skamania County, Washington	2,347	601,5
Public Utility District No. 1 of Snohomish County, Washington	93,892	19,982,4
South Side Electric Lines, Inc.	372	89,4
City of Springfield, Oregon	5,163	1,151,5
Town of Sumas, Washington	308	60,4
Surprise Valley Electrification Corporation	2,383	623,0
City of Tacoma, Washington	77,273	24,032,5
Tanner Electric	562	118,3
Tillamook Peoples' Utility District	10,040	2,303,2
Umatilla Electric Cooperative Association	3,481	992,5
Unity Light and Power Company	865	196,0
Vera Irrigation District No. 15	2,728	452,0
Vigilante Electric Cooperative, Inc.	2,585	594,8
Public Utility District No. 1 of Wahkiakum County, Washington	1,880	317,1
Wasco Electric Cooperative, Inc.	2,083	585,9
West Oregon Electric Cooperative, Inc.	2,269	467,2
TOTAL	846,440	$198,142,4

(A) Based upon current Bonneville rate schedules. The next rate adjustment date for all power sales contracts is December 20, 1974.

(B) Based upon average annual costs; costs could be lower in early years.

* Group I Participants.

† Group II Participants.

(3) Anticipated Bonneville Billings 1978-1979(A)	(4) ESTIMATED Participant's Share of Annual Costs of Nuclear Project No. 2 1978-1979(B) 6%	(5) 7%	(6) Participant's Share of Project Capability Initial Share	(7) Adjusted Share for Group I and II
$ 107,000	$ 87,200	$ 94,800	00.202	
418,700	353,800	384,800	00.820	
120,500	99,700	108,400	00.231	
769,400	624,900	678,500	01.446	
121,000	101,000	109,800	00.234	
682,200	529,500	575,700	01.227	
270,300	210,600	229,000	00.488	
303,100	251,600	273,500	00.583	
2,600	—	—	00.000	00.005*
155,400	126,900	137,900	00.294	
157,200	101,800	110,700	00.236	
75,700	64,300	69,900	00.149	
235,100	196,300	213,500	00.455	
31,200	22,000	23,900	00.051	
101,100	82,000	89,100	00.190	
517,500	449,600	488,900	01.042	
401,000	312,800	340,200	00.725	
802,900	648,600	705,200	01.503	
1,228,800	1,042,600	1,133,600	02.416	
10,500	8,200	8,900	00.019	
446,300	368,100	400,200	00.853	
157,700	129,900	141,200	00.301	
1,488,000	1,191,400	1,295,500	02.761	
10,000	8,600	9,400	00.020	
179,900	—	—	00.000	00.348*
135,000	113,100	122,900	00.262	
327,200	195,500	212,600	00.453	
90,600	73,400	79,800	00.170	
7,970,700	3,448,700	3,749,900	07.992	07.193†
311,300	236,000	256,700	00.547	
16,308,200	7,364,800	8,009,300	17.069	15.363†
38,100	31,500	34,300	00.073	
236,000	156,600	170,300	00.363	
25,000	20,700	22,500	00.048	
168,600	139,400	151,600	00.323	
7,354,300	—	—	00.000	
65,700	52,600	57,200	00.122	
939,400	746,100	811,300	01.729	
32,200	15,500	16,900	00.036	
107,000	88,000	95,700	00.204	
374,200	302,500	328,900	00.701	
152,700	126,900	137,900	00.294	
176,300	141,500	153,900	00.328	
176,300	147,600	160,500	00.342	
99,700	78,500	85,400	00.182	
$82,373,700	$43,152,000	$46,921,000	100.000%	

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EXHIBIT II

R. W. BECK AND ASSOCIATES

ANALYTICAL AND CONSULTING ENGINEERS

PLANNING
DESIGN
RATES
ANALYSES
EVALUATIONS
MANAGEMENT

200 TOWER BUILDING
SEATTLE, WASHINGTON 98101
TELEPHONE 206-622-5000

SEATTLE, WASHINGTON
DENVER, COLORADO
PHOENIX, ARIZONA
ORLANDO, FLORIDA
COLUMBUS, NEBRASKA
BOSTON, MASSACHUSETTS

FILE NO. SS-1119-NP-AAS

December 30, 1970

Board of Directors
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Kennewick, Washington

Gentlemen:

Subject: Summary Engineering Report
Washington Public Power Supply System
Nuclear Project No. 2

Presented herewith is a summary of our analyses, investigations and studies with respect to the proposal by the Washington Public Power Supply System (System) to issue $15,000,000 of its Washington Public Power Supply System Nuclear Project No. 2 Revenue Notes (Notes) for the purpose of paying certain initial costs of acquiring and constructing a nuclear-fueled electric-generating plant of approximately 1,100,000 kilowatts and related facilities (Project) and placing it into operation. The Notes will mature in 3½ years. They are callable after 2½ years; it is anticipated that they will be retired from the proceeds of Bonds issued to provide permanent financing of the Project.

The costs to be financed from the proceeds of the Notes include the cost of preliminary work and expenses incurred in connection with the Project, such as (a) engineering and other professional services, (b) site studies and surveys for the Project, (c) obtaining permits, licenses and approvals, (d) preparing detailed plans and specifications for the Project and (e) other costs associated therewith (generally referred to herein as "Initial Work").

It is proposed that the Initial Work will be that which is necessary to thoroughly investigate the site of the Project, to obtain a certification of the site by the State of Washington, to obtain a construction permit from the United States Atomic Energy Commission (AEC) and, in general, to accomplish any other work to be undertaken prior to permanently financing the construction of the Project.

The System is a joint operating agency organized under the laws of the State of Washington and has 19 members consisting of 18 public utility districts and one municipality, all located within the State of Washington. The System owns and operates the Packwood Lake Hydroelectric Project of 27,500 kva of nameplate capacity located in Lewis County, Washington, and the Hanford No. 1 steam-electric generating plant of approximately 860,000 kilowatts located in Benton County, Washington. Steam is provided to this latter project from a nuclear reactor owned and operated by the AEC at its Hanford Works near Richland, Washington. The System issued $13,700,000 of Packwood Lake Hydroelectric Project Revenue Bonds, Series of 1962 and 1965, to finance construction of the Packwood Lake Hydroelectric Project and $122,000,000 of Hanford Project Electric Revenue Bonds, Series of 1963, to finance construction of the Hanford No. 1 Project. Each of these projects is a separate utility system and the revenues of each are respectively pledged to the separate systems.

The System is now proposing to construct a 1,100,000-kilowatt nuclear power plant at a site to be selected on the Hanford Reservation of the AEC located north of the City of Richland on the Columbia River, to be financed as a separate utility system. As an initial step in the construction of the Project, it is necessary to conduct investigations and studies to finally select a specific site, to prepare plans and specifications with respect to the Project in order to refine cost estimates, and to obtain necessary approvals for construction of the Project by the State of Washington and by the AEC.

Description of the Project

It is proposed that the Project will consist of a nuclear-electric generating plant and associated facilities having a nominal rating of approximately 1,100,000 kilowatts. Plant cooling water will be provided by the use of cooling towers or cooling ponds, with makeup water obtained from the Columbia River. Power will be stepped up to high voltage and delivered into the Bonneville Power Administration (BPA) transmission system in the vicinity of the Project.

Permits and Licenses

Prior to construction of the Project, the System will require granting of a site certification by the State of Washington and issuance of a construction permit by the AEC.

Financing Program

The System proposes to finance the construction of the Project through the issuance of bonds to be retired from revenues of the Project. In order to finance Initial Work, the System proposes to issue $15,000,000 of notes to mature July 1, 1974. Interest for the 42-month period of the notes will be set aside from the proceeds of the notes into a separate account to be used for interest payments as necessary until the notes mature.

Construction Program

The construction schedule as prepared by the System and Burns and Roe, Inc., the Architect-Engineer selected by the System to design and supervise construction of the Project, calls for design work to proceed immediately, with award of the contract for the nuclear steam supply system to take place by May 1971. Concurrently, the preparation of the Preliminary Safety Analysis Report will be undertaken with submission to the AEC scheduled for the fall of 1971. Application for the AEC construction permit will be filed with the filing of the Preliminary Safety Analysis Report, with actual receipt of the construction permit scheduled for late in 1972. It is proposed to file application to the State of Washington for site certification for a thermal power plant soon after issuance of the Notes and prosecute such application to obtain certification by early 1972.

Site preparation and construction of temporary facilities are proposed to start in the spring of 1972 with actual construction scheduled to start in the fall of 1972.

Certain of the Project components are expected to be ready for preoperational testing by the spring of 1976. Fuel loading is scheduled for the spring of 1977. Initial criticality of the reactor is scheduled for the summer of 1977 with Commercial Operation scheduled for September 1977.

Initial Financing Program

The proceeds of the Notes are designed to provide the funds necessary to meet the foregoing construction schedule to May 1, 1973; this takes into account possible delays in receipt of the AEC Construction Permit and in the Washington State site certification. Interest on the Notes for a further 14-month period will be available, in the event that financing of the Project is further delayed.

The estimated disposition of proceeds of the $15,000,000 of Notes, based on an assumed interest rate of 5%, is given in the following table:

Estimated Disposition of Proceeds
$15,000,000 Notes

Preliminary Expenses*		$ 250,000
Construction Costs:		
Site Preparation	$1,460,000	
Nuclear Steam Supply System	1,977,000	
Architect-Engineer	5,303,000	
Preliminary Construction	1,451,000	
Total Construction Costs		10,191,000
Contingency and Escalation		1,529,000
System Direct Costs		1,300,000
Other Professional Services		300,000
Note Discount and Other Financing Expenses		525,000
Capitalized Interest (estimated at 4%)		2,100,000
Gross Costs		$16,195,000
Less: Investment Earnings (estimated at 5%)		1,195,000
Principal Amount of Note Issue		$15,000,000

* Includes repayment of advances made to the System by the Public Power Council Foundation of the Northwest Public Power Association and reimbursement of Grays Harbor Public Utility District No. 1 and the System general fund for payment of costs relating to preliminary site investigation and other preliminary costs.

Permanent Financing Program

The current program provides that permanent financing will be initiated in the spring of 1973 through the issuance of long-term bonds to be retired from revenues of Project. These bonds are proposed to be issued to provide funds to retire the Notes and to pay the balance of the costs associated with the construction of the Project and placing it into operation, and to be issued either as a single issue or in several issues.

It is proposed that funds necessary to provide one-half year's interest in a reserve account in the bond fund, to provide working capital, to provide an initial reserve and contingency fund and to provide a contingency fuel fund will be funded under the Net Billing Agreements in advance of the expected date of commercial operation. Based on this procedure and further assuming sale of a single bond issue to finance the Project on May 1, 1973, the estimated amounts of bonds to be issued under two different levels of interest rate at the time of issuance of the bonds are shown in the following tabulation:

	Assumed Interest Rate on Bonds	
	6%	7%
Direct Construction Cost	$203,608,000	$203,608,000
Contingencies and Escalation	60,466,000	60,466,000
Engineering and Construction Management	16,000,000	16,000,000
Owners Direct Cost	7,825,000	7,825,000
Subtotal*	$287,899,000	$287,899,000
Other Costs	980,000	980,000
Initial Nuclear Core*	34,000,000	34,000,000
Capitalized Interest During Construction	103,977,000	124,267,000
Financing, Legal and Miscellaneous Expense Including Bond Discount	9,628,000	9,863,000
Gross Requirement	$436,484,000	$457,009,000
Deduct: Estimated Income from Investment of Construction Fund and Bond Reserve Account	51,584,000	62,709,000
Net Requirement	$384,900,000	$394,300,000

* As estimated by Burns and Roe, Inc.

Included in the foregoing are the amounts expended from the $15,000,000 Note issue as follows:

Subtotal, Direct Construction Costs	$13,320,000
Other Costs	980,000
Total	$14,300,000

The balance of the funds necessary to retire the Notes as of May 1, 1973 is expected to come from the estimated $700,000 remaining in the Note Interest Account as of that date.

The foregoing estimate should be considered preliminary in nature until such time as sufficient design and pricing information has been developed to provide more definitive cost estimates.

In addition to the foregoing amounts obtained through issuance of bonds, it is expected that amounts to be paid by the Participants during the period beginning January 1, 1977 and extending to September 1, 1977 under the Net Billing Agreements will be as follows:

	Assumed Interest Rate on Bonds	
	6%	7%
Reserve Account in Bond Fund	$11,547,000	$13,801,000
Working Capital	3,000,000	3,000,000
Reserve and Contingency Fund	3,000,000	3,000,000
Contingency Fuel Fund	8,000,000	8,000,000
Total	$25,547,000	$27,801,000

Project Output

The Project is expected to have a nominal net peaking capability of 1,100,000 kilowatts and to be capable of producing about 8,400,000 kilowatt-hours annually. During a critical period of power supply in the Pacific Northwest caused by water shortage, it is expected that the Project would be called upon to produce the full amount of energy that it is capable of producing. During other periods, however, there will be times when surplus water will be available to generate power at existing hydroelectric projects thereby permitting a reduction in the total amount of energy produced at the thermal-electric projects to be constructed under the Hydro Thermal Program.

Based on studies prepared by the BPA, it is expected that the average output required from the Project will be in the order of 800,000 average kilowatts. Annual generation would therefore average about 7,000,000,000 kilowatt-hours.

Annual Cost

Preliminary estimates of annual costs have been prepared based on two assumed interest rates on the bonds proposed to be issued in 1973, and further based on 1970 costs of labor and materials escalated to a 1977 operating date. As in the case of the bond issue, the annual costs are subject to refinement as additional design information becomes available.

Assuming generation of 7,000,000,000 kwh annually, the estimated average annual and unit costs of the Project are as follows:

Estimated Average Annual Cost

Hanford Project No. 2

	Assumed Interest Rate on Bonds 6%	Assumed Interest Rate on Bonds 7%
FIXED COSTS:		
Interest and Amortization (1)	$26,548,000	$30,452,000
Payments to Reserve and Contingency Fund	2,655,000	3,045,000
Insurance:		
Nuclear Liability	430,000	430,000
Other	1,200,000	1,200,000
Operation and Maintenance (Fixed)	3,144,000	3,144,000
Administrative and General	1,226,000	1,226,000
Subtotal	$35,203,000	$39,498,000
Less: Surplus of Prior Year's Payment to Reserve and Contingency Fund (2)	(1,455,000)	(1,845,000)
Total Fixed Costs	$33,748,000	$37,652,000
VARIABLE COSTS:		
Fuel Cost	$10,020,000	$10,020,000
Operation and Maintenance (Variable)	737,000	737,000
Total Variable Costs	$10,757,000	$10,757,000
TOTAL ANNUAL COSTS	$44,505,000	$48,409,000
Less: Interest Earnings on Reserve Funds (3)	(1,353,000)	(1,488,000)
NET ANNUAL COSTS	$43,152,000	$46,921,000
NET ANNUAL COST PER KILOWATT-HOUR (7,000,000,000 Kwh) (4)	6.16 mills	6.70 mills

(1) Based on level debt service and a 35 year amortization.

(2) Computed as follows:

	Assumed Interest Rate on Bonds 6%	Assumed Interest Rate on Bonds 7%
Payment to Reserve and Contingency Fund	$2,655,000	$3,045,000
Less: Amount Required for Renewals, Replacements and Additions	1,200,000	1,200,000
Net Surplus	$1,455,000	$1,845,000

(3) Assumed earnings at 6% of the Reserve Account in the Bond Fund, the Reserve and Contingency Fund and the Contingency Fuel Fund.

(4) Net annual costs per kwh assuming annual generation of 8,400,000,000 kwh during critical periods are estimated to average 5.14 mills per kwh assuming 6% interest rate and 5.59 mills per kwh assuming 7% interest rate.

Sale of Power

The output of the Project will be purchased by 95 public agency Participants nine of which have zero participations at the present time. The City of Tacoma, listed as one of the 9 Participants purchasing a zero share, has not executed a Net Billing Agreement. The other 94 Participants have executed Net Billing Agreements providing for the purchase of 100 percent of the Project Output and obligating themselves, pursuant to the Net Billing Agreements, in the aggregate to pay all of the Project annual costs. The number of Participants and the extent of participation follows by main categories:

Type	Number	Percent Participation (1)
Districts	22(2)	60.213
Municipalities	28(3)	19.294
Cooperatives	45	20.493
Total	95	100.000

(1) At the present time. May be modified prior to January 1, 1978 pursuant to Exhibit A to the Net Billing Agreements.
(2) 17 Public Utility Districts. 4 Peoples Utility Districts, and 1 Irrigation District.
(3) 9 Municipalities including the City of Tacoma which has not entered into a Net Billing Agreement have zero participation at the present time. Summary statistical information on the Participants is given in Table 1 at the end of this report.

Each Participant's share of the output of the Project will be assigned to BPA which, in payment for such assignment, will credit the Participant each year, against amounts owing to BPA by such Participant, a total amount equal to the payment which the Participant is required to make to the System for such year. This process referred to herein as "net billing" is more fully discussed in the Official Statement to which this report is attached. In the event that credits allowed from BPA during any year are less than the amounts paid by the Participant to the System, the Participants are nevertheless obligated to make the required payments to the System.

The percentage participation in the Project has been developed so that based on present estimates it is expected that the available credits from BPA during any year will exceed the estimated payments to be made to the System by over 15%.

Conclusions

Based on our study and analyses of the System's proposal to construct an 1,100,000 kilowatt nuclear-fueled steam-electric project in the vicinity of Richland, Washington, we are of the opinion that:

1. The output of the Project is required to meet the load growth of the utility systems of the Pacific Northwest under the Hydro-Thermal Program and can readily be absorbed by the Participants when the Project is scheduled for initial operation.

2. The System's program for financing the Initial Work is sound and should provide sufficient funds to permit obtaining the information and permits required to secure financing of the Project.

3. The Net Billing Agreements between the System, each Participant and BPA provide a sound basis for proceeding with the financing of the Initial Work through issuance of $15,000,000 of Notes as proposed.

4. The estimated cost of the output of the Project is reasonable and comparable to costs expected from similar projects to be developed within the same time frame.

Respectfully submitted,

RW Beck and Associates

R. W. Beck and Associates

Table 1

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 2 PARTICIPANTS

Summary of Financial and Statistical Data for 1969

	Districts(1)	Municipalities(2)	Cooperatives	Total
STATISTICS				
Customers:				
Residential	274,114	360,593	105,545	737,252
Total	314,634	408,041	123,765	846,440
Kilowatt-hour Sales (000)	10,344,231	11,775,699	2,542,971	24,662,901
Kilowatt-hour Purchases (000):				
BPA (NPR Exchange)	1,142,780	147,857	196,387	1,487,024
BPA	9,581,533	3,242,413	2,606,983	15,430,929
Other	100,201	741,507	63	841,771
Total Kilowatt-hour Purchases (000)	10,824,515	4,131,777	2,803,433	17,759,724
Kilowatt-hours Generated (000)	—	8,670,785	12,763	8,683,548
Total Kilowatt-hour Requirement (000)	10,824,514	12,802,562	2,816,196	26,443,272
Peak Demands—Kilowatts	2,300,537	2,610,922	685,910	5,597,369
INCOME AND OPERATING STATEMENT				
Income:				
Total Operating Revenues	$ 74,178,819	$ 93,342,934	$ 30,620,746	$ 198,142,499
Other Income (Non-operating)	1,469,788	1,796,318	355,235	3,621,341
Total Income	$ 75,648,607	$ 95,139,252	$ 30,975,981	$ 201,763,840
Operating Expenses:				
Purchased Power:				
BPA (NPR Exchange)	$ 3,667,778	$ 403,776	$ 634,866	$ 4,706,420
BPA	28,875,579	9,569,295	8,392,348	46,837,122
Other	757,109	3,425,134	2,378	4,184,621
Total Purchased Power Expense	33,300,366	13,398,205	9,029,592	55,728,163
Generating Expense	23,871	5,330,641	48,839	5,403,351
Total Power Supply Expense	33,324,237	18,728,846	9,078,431	61,131,514
Other Expense (including Depreciation and Taxes)	29,591,136	54,922,916	16,638,492	101,152,544
Total Operating Expense	$ 62,915,373	$ 73,651,762	$ 25,716,923	$ 162,284,058
CONDENSED BALANCE SHEET				
Assets:				
Net Utility Plant	$203,280,178	$588,205,568	$142,695,089	$ 934,180,835
Other Property and Investments	17,371,717	18,261,977	6,656,424	42,290,118
Current Assets	28,278,009	83,355,120	12,185,123	123,818,252
Deferred Debits	5,474,164	8,217,824	468,051	14,160,039
Total Assets	$254,404,068	$698,040,489	$162,004,687	$1,114,449,244
Liabilities:				
Long-term Debt	$ 58,201,151	$340,379,000	$122,950,918	$ 521,531,069
Current Liabilities	17,562,830	52,321,043	3,457,303	73,341,176
Deferred Credits	6,598,026	1,235,643	542,143	8,375,812
Reserves	478,411	8,207,430	21,434	8,707,275
Contributions in Aid of Construction	4,568,496	13,077,909	3,988,882	21,635,287
Retained Earnings	166,995,154	282,819,464	31,044,007	480,858,625
Total Liabilities	$254,404,065	$698,040,489	$162,004,687	$1,114,449,244
PERCENT PARTICIPATION (3)	60.213	19.294	20.493	100.00

(1) Public Utility Districts, Peoples Utility Districts, and 1 Irrigation District.
(2) Includes the City of Tacoma which is listed as a Participant but which has not entered into a Net Billing Agreement.
(3) As of the present time. May be modified prior to January 1, 1978 pursuant to Exhibit A of the Net Billings Agreements.

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EXHIBIT III

FORM OF NET BILLING AGREEMENT

Contract No.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PROJECT NO. 2

AGREEMENT

executed by the

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR

acting by and through the

BONNEVILLE POWER ADMINISTRATOR

and

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

and

(THE PARTICIPANT)

(Net Billing Agreement)

INDEX TO SECTIONS

This **AGREEMENT,** executed January 4, 1971, by the UNITED STATES OF AMERICA (hereinafter called "the Government"), Department of the Interior, acting by and through the BONNEVILLE POWER ADMINISTRATOR (hereinafter called "the Administrator"), and WASHINGTON PUBLIC POWER SUPPLY SYSTEM (hereinafter called "Supply System"), a municipal corporation of the State of Washington, and (Participant's Name) a corporation of the State of (hereinafter called "the Participant"),

WITNESSETH:

WHEREAS Supply System proposes to design, finance, construct, operate and maintain the Project; and

WHEREAS the Participants have proposed to purchase the Project Capability from Supply System for assignment to the Administrator hereunder; and

WHEREAS Supply System and the Participant have each determined that the sale by Supply System to the Participant of the Participant's Share and assignment thereof to the Administrator as herein provided will be beneficial to it by reducing the cost of and increasing the amounts of firm power and energy which will be available to serve its members or customers in the future; and

WHEREAS the Administrator has determined that the acquisition of the Participant's Share as herein provided will assist in attaining the objectives of the Bonneville Project Act and other statutes which pertain to the disposition of electric power and energy from Government projects in the Pacific Northwest by enabling the Government to make optimum use of the Federal Columbia River Power System, and that the integration of the capability of the Project with the hydroelectric resources of the Federal Columbia River Power System as provided herein will enable the Administrator to make available additional firm power and energy to meet the needs of his customers; and

WHEREAS the Administrator will pool electric power and energy acquired hereunder with other power available to the Administrator from the Federal Columbia River Power System so that any costs or losses associated with acquiring such power and energy will be borne by the Administrator's ratepayers through rate adjustments if necessary; and

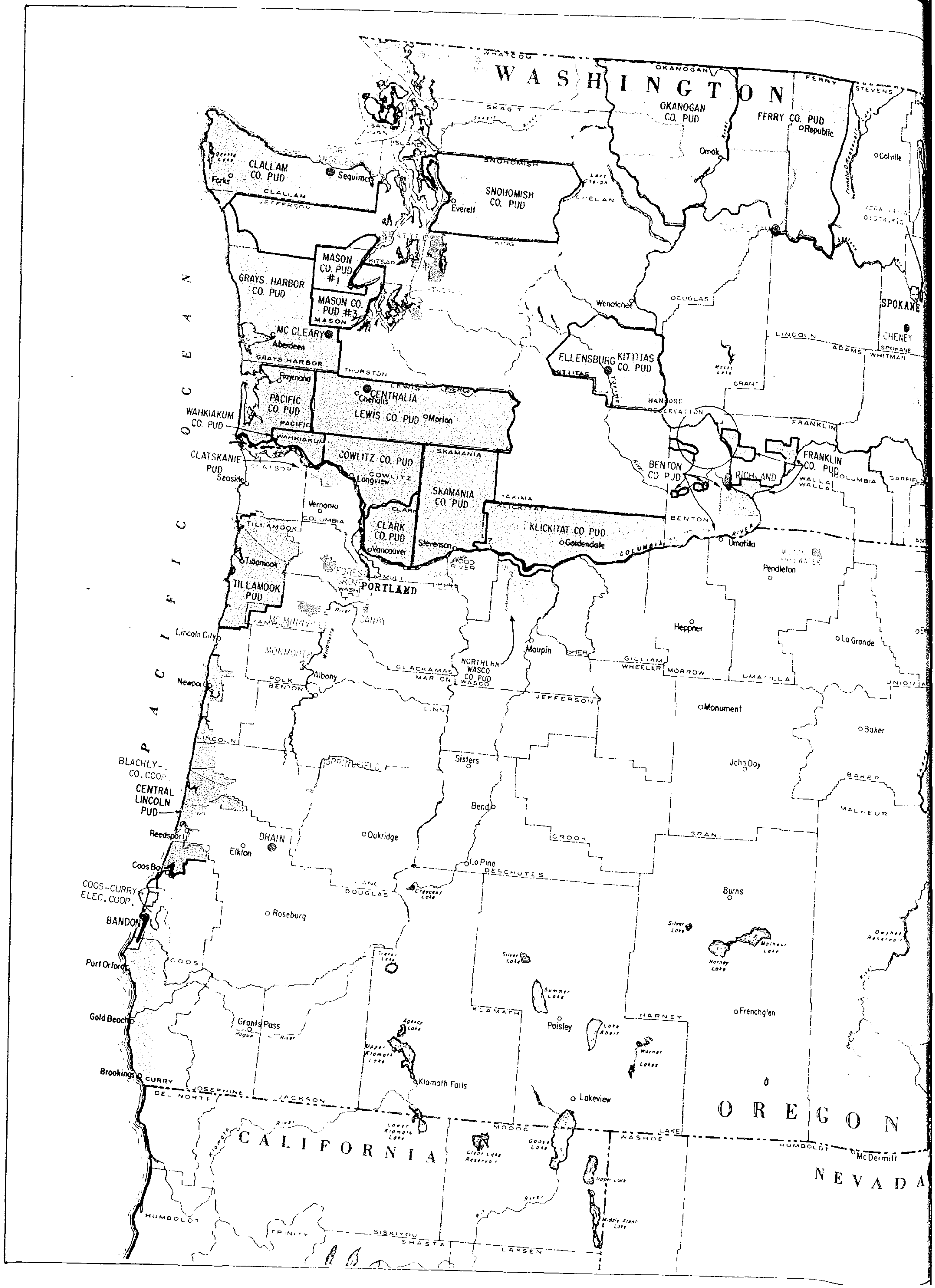
WHEREAS the Participant proposes to assign, and the Administrator proposes to acquire the Participant's Share; and

WHEREAS the Administrator and the Participant are parties to agreements which require payments by the Participant to the Administrator which may be used to offset payments by the Administrator to the Participant hereunder under a net billing procedure; and

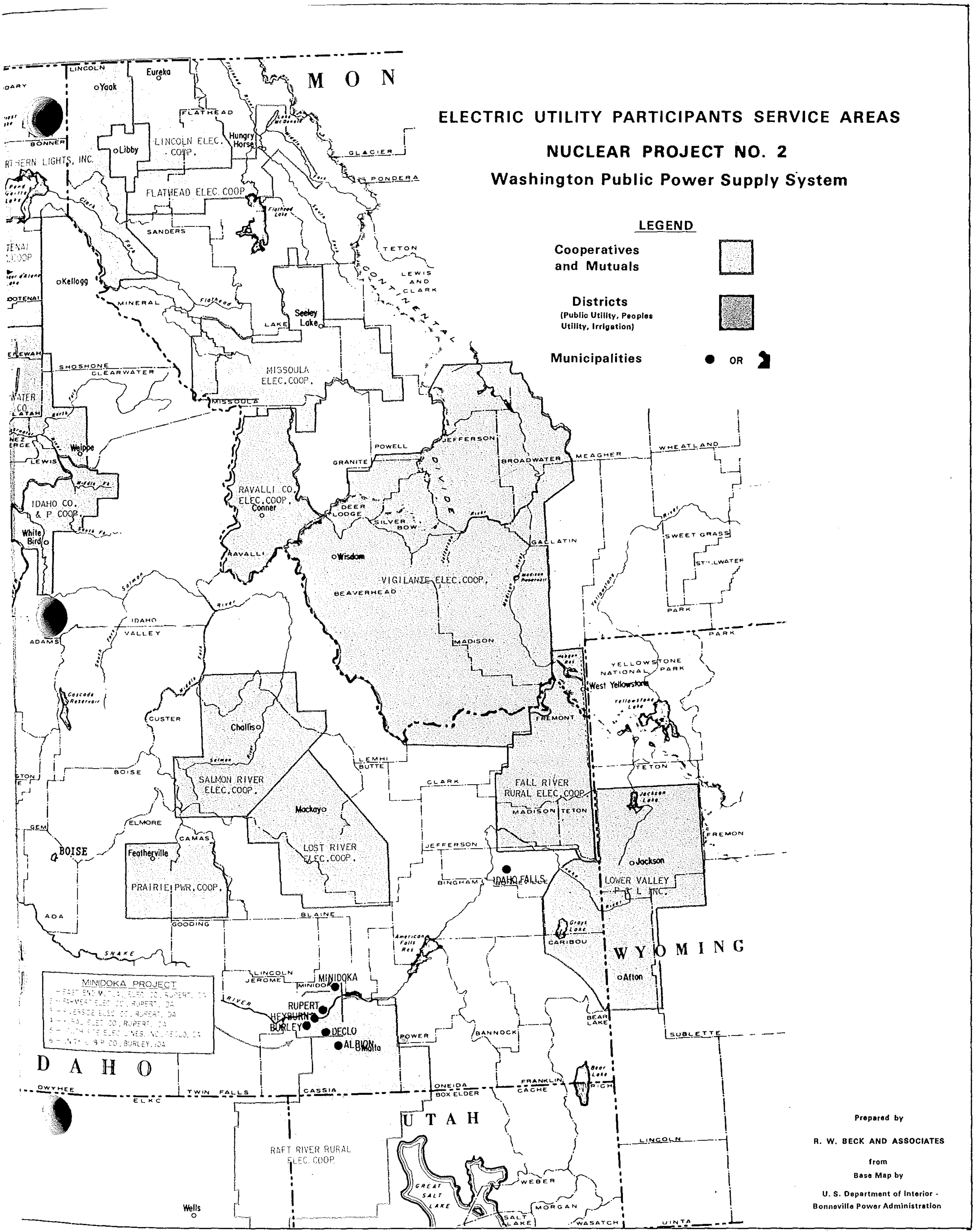
WHEREAS Supply System and the Administrator propose to enter into the Project Agreement (designated as Contract No. 14-03-19121) simultaneously with this agreement which will provide among other things for relationships between Supply System and the Administrator with respect to Project construction, operation, maintenance and budgets; and

WHEREAS the Administrator and Supply System propose to enter into agreements with the other Participants containing terms and conditions substantially identical to those herein; and

WHEREAS the Supply System is organized under the laws of the State of Washington (Rev. Code of Washington, Ch. 43.52, cum supp.) and is authorized by law to construct, acquire and operate works, plants, and facilities for the generation and/or transmission of electric power and energy and to enter into contracts with the Administrator and public and private organizations for the disposition and distribution of electric energy produced thereby; and



WASHINGTON
OREGON
CALIFORNIA
NEVADA
PACIFIC OCEAN
OKANOGAN CO. PUD
FERRY CO. PUD
Republic
Omak
Colville
CLALLAM CO. PUD
Forks
Sequim
SNOHOMISH CO. PUD
Everett
MASON CO. PUD #1
MASON CO. PUD #3
GRAYS HARBOR CO. PUD
MC CLEARY
Aberdeen
Wenatchee
SPOKANE
CHENEY
ELLENSBURG
KITTITAS CO. PUD
Raymond
PACIFIC CO. PUD
CENTRALIA
Chehalis
LEWIS CO. PUD
Morton
WAHKIAKUM CO. PUD
CLATSKANIE PUD
Seaside
COWLITZ CO. PUD
Longview
SKAMANIA CO. PUD
CLARK CO. PUD
Vancouver
Stevenson
KLICKITAT CO PUD
Goldendale
BENTON CO. PUD
RICHLAND
FRANKLIN CO. PUD
HANFORD RESERVATION
Umatilla
Pendleton
Vernonia
Tillamook
TILLAMOOK PUD
FOREST GROVE
PORTLAND
HOOD RIVER
CANBY
MC MINNVILLE
MONMOUTH
Lincoln City
Newport
Albany
NORTHERN WASCO CO PUD
Maupin
Heppner
La Grande
Monument
Baker
John Day
Sisters
Bend
BLACHLY-LANE CO. COOP.
CENTRAL LINCOLN PUD
SPRINGFIELD
Reedsport
DRAIN
Elkton
Oakridge
La Pine
Coos Bay
COOS-CURRY ELEC. COOP.
BANDON
Roseburg
Burns
Port Orford
Gold Beach
Grants Pass
Paisley
Frenchglen
Brookings
Klamath Falls
Lakeview
McDermitt
WHATCOM
OKANOGAN
FERRY
STEVENS
SKAGIT
SAN JUAN
ISLAND
SNOHOMISH
CLALLAM
JEFFERSON
CHELAN
KING
KITSAP
MASON
DOUGLAS
LINCOLN
ADAMS
SPOKANE
WHITMAN
GRAYS HARBOR
THURSTON
LEWIS
PIERCE
KITTITAS
GRANT
FRANKLIN
PACIFIC
WAHKIAKUM
SKAMANIA
COWLITZ
CLARK
YAKIMA
KLICKITAT
BENTON
WALLA WALLA
COLUMBIA
GARFIELD
TILLAMOOK
MULT
WASH
CLACKAMAS
MARION
WASCO
POLK
BENTON
SHERMAN
GILLIAM
WHEELER
MORROW
UMATILLA
UNION
LINN
JEFFERSON
LINCOLN
LANE
DOUGLAS
CROOK
DESCHUTES
GRANT
BAKER
MALHEUR
COOS
KLAMATH
HARNEY
CURRY
JOSEPHINE
JACKSON
LAKE
DEL NORTE
MODOC
WASHOE
HUMBOLDT
SISKIYOU
TRINITY
SHASTA
LASSEN



ELECTRIC UTILITY PARTICIPANTS SERVICE AREAS
NUCLEAR PROJECT NO. 2
Washington Public Power Supply System
LEGEND
Cooperatives and Mutuals
Districts (Public Utility, Peoples Utility, Irrigation)
Municipalities ● OR
MON
IDAHO
WYOMING
UTAH
LINCOLN ELEC. COOP.
FLATHEAD ELEC. COOP
MISSOULA ELEC. COOP.
RAVALLI CO. ELEC. COOP.
VIGILANTE ELEC. COOP.
IDAHO CO. & P. COOP
SALMON RIVER ELEC. COOP.
LOST RIVER ELEC. COOP.
PRAIRIE PWR. COOP.
FALL RIVER RURAL ELEC. COOP
LOWER VALLEY P. & L. INC.
RAFT RIVER RURAL ELEC. COOP.
NORTHERN LIGHTS, INC.
MINIDOKA PROJECT
Eureka
Yaak
Libby
Hungry Horse
Seeley Lake
Kellogg
Weippe
Conner
Wisdom
White Bird
Challis
Mackay
Featherville
BOISE
IDAHO FALLS
West Yellowstone
Jackson
Afton
MINIDOKA
RUPERT
HEYBURN
BURLEY
DECLO
ALBION
Wells
Prepared by
R. W. BECK AND ASSOCIATES
from
Base Map by
U. S. Department of Interior - Bonneville Power Administration

WHEREAS the Administrator is authorized pursuant to law to dispose of electric power and energy generated at various federal hydroelectric projects in the Pacific Northwest and to enter into related agreements;

NOW THEREFORE, the parties hereto mutually agree as follows:

1. *Definition and Explanation of Terms.*

(a) "Annual Budget" means the budget adopted by Supply System not less than 45 days prior to the beginning of each Contract Year which itemizes the projected costs of the Project applicable to such Contract Year, or, in the case of an amended Annual Budget, applicable to the remainder of such Contract Year. The Annual Budget, as amended from time to time, shall make provision for all of Supply System's costs, including accruals and amortizations, resulting from the ownership, operation (including cost of fuel), and maintenance of the Project and repairs, renewals, replacements, and additions to the Project, including, but not limited to, the amounts which Supply System is required under the Project Bond Resolution to pay in each Contract Year into the various funds provided for in the Project Bond Resolution for debt service and all other purposes; *provided, however,* that the Annual Budget for any portion of a Contract Year prior to the Date of Commercial Operation or September 1, 1977, whichever occurs first, shall include only such amounts as may be agreed upon by Supply System and the Administrator.

All taxes imposed and required by law to be paid, and which are due and payable in a Contract Year, shall be included in the Annual Budget for that Contract Year as a Project Cost. To the extent Supply System is permitted by law to negotiate for payments in lieu of taxes or other negotiated payments to state or local taxing entities, the Annual Budget shall also include the amounts of such negotiated payments; *provided, however,* that Supply System shall not agree to such a negotiated payment if in any Contract Year the sum of such negotiated payments and taxes imposed by law would exceed the total amount of ad valorem taxes that Supply System would have paid in that year to such taxing entities if the Project or portion thereof, within the boundaries of each such taxing entity, were subject to ad valorem taxes and its valuation for tax purposes were added to the valuation of the property subject to ad valorem taxes by such taxing entity, but with its millage rate reduced so that the amount of ad valorem taxes raised would be unchanged.

(b) "Billing Statement" means the written statement prepared by Supply System that shows the amount to be paid to Supply System by the Participant for the Participant's Share for a Contract Year or, in the case of an amended Billing Statement, for the remainder of such Contract Year. Such amount shall be determined as to the Participant by multiplying the amount of the Annual Budget or the amended Annual Budget, as the case may be, less any other funds which shall be specified in the Annual Budget as being payable from sources other than the payments to be made under the Net Billing Agreements, by the Participant's Share. At the end of each Contract Year any amount over or under billed during such year will be reflected in the Billing Statement for the following Contract Year.

(c) "Contract Year" (1) means the period commencing on the Date of Commercial Operation, or on January 1, 1977, whichever occurs first, and ending at 12 p.m. on the following June 30, and (2) thereafter means the 12-month period commencing at 12 p.m. on June 30, except that the last Contract Year shall end on the date of termination of this agreement.

(d) "Date of Commercial Operation" means the date fixed pursuant to section 1(d) of the Project Agreement.

(e) "Net Billing Agreements" means this and all other agreements for the Project similar to this agreement entered into by Supply System, each of the Participants and the Administrator (designated as Contracts No. 14-03-19122 through 14-03-19216, inclusive).

(f) "Participant's Share" means the decimal fraction share of Project Capability purchased by the Participant hereunder specified in Exhibit A, plus, during any period in which a decimal fraction is assigned to the Participant pursuant to sections 7(f) or 12 hereof or pursuant to section 7(b) in the other Net Billing Agreements, the decimal fraction share or shares so assigned, and minus any reductions under section 12 hereof or under an assignment by the Participant under section 7(b) hereof during any period in which such reductions or assignments are in effect.

(g) "Participants" means those entities which are specified in Exhibit A or which become assignees of all or part of the Share of Project of Capability of any Participant pursuant to sections 7(b) or 15.

(h) "Project" means the nuclear generating plant and related property as described in Exhibit B. Said Exhibit B shall be revised from time to time by mutual agreement of Supply System and the Administrator, after consultation with the Participant, but in any event shall conform to the description of the Project in the Project Bond Resolution which authorizes the issuance of Project Bonds in an amount sufficient to pay the costs of acquiring and constructing the Project.

(i) "Project Agreement" means the agreement for financing construction, ownership and operation of the Project, as the same may be amended, executed by Supply System and the Administrator (designated as Contract No. 14-03-19121).

(j) "Project Bonds" means any bond, bonds or other evidences of indebtedness issued in connection with the Project pursuant to the Project Bond Resolution (1) to finance or refinance Supply System's costs associated with planning, designing, financing, acquiring and constructing the Project pursuant to the Project Bond Resolution and (2) for any other purpose authorized thereby.

(k) "Project Bond Resolution" means the resolution or resolutions adopted or supplemented by Supply System, as the same may be amended or supplemented, to authorize the Project Bonds.

(l) "Project Capability" means the actual electrical generating capability, if any, of the Project at any particular time (including times when the Project is not operable or operating or the operation thereof is suspended, interrupted, interfered with, reduced or curtailed, in each case in whole or in part), less Project station use and losses.

(m) "Project Consultant" means an individual or firm, of national reputation having demonstrated expertise in the field of the matter or item referred to it, appointed among other things, for the resolution of a difference regarding a matter or item referred by Supply System. A different Project Consultant may be appointed for each matter or item referred.

(n) "Prudent Utility Practice" at a particular time means any of the practices, methods, and acts engaged in or approved by a significant proportion of the electrical utility industry prior to such time, or any of the practices, methods, and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at the lowest reasonable cost consistent with reliability, safety and expedition. Prudent Utility Practice shall apply not only to functional parts of the Project but also to appropriate structures, landscaping, painting, signs, lighting, and other facilities and public relations programs reasonably designed to promote public enjoyment, understanding and acceptance of the Project and to other activities relating to the statutory responsibilities and duties of Supply System. Prudent Utility Practice is not intended to be limited to the optimum practice, method or act, to the exclusion of all others, but rather to be a spectrum of possible practices, methods or acts. In evaluating whether any act or proposal conforms to Prudent Utility Practice, the parties and any Project Consultant shall take into account the objective to integrate the entire Project Capability with the hydroelectric resources of the Federal Columbia River Power System and to achieve optimum utilization of the resources of that system taken as a whole, and to achieve efficient and economical operation of that system. Any practice, method or act which pursuant to the Project Agreement is determined to be Prudent Utility Practice shall be deemed to be Prudent Utility Practice hereunder.

2. *Exhibits.* Exhibits A through C are by this reference incorporated herein and made a part of this agreement. Supply System and the Participant shall each be the "Contractor" as that term is used in Exhibit C.

3. *Term of Agreement.* This agreement shall be effective upon execution and delivery and, except as provided in section 10(c) and except as to accrued obligations and liabilities, shall terminate on the date the Project Agreement terminates.

4. *Financing, Design, Construction, Operation and Maintenance of the Project.* Supply System, in good faith and in accordance with Prudent Utility Practice, shall use its bests efforts to arrange for financing, design, construction, operation and maintenance of the Project.

5. *Sale, Purchase and Assignment of Participant's Share.*

(a) *Sale of Participant's Share.* Supply System hereby sells, and the Participant hereby purchases, the Participant's Share. The purchase price to be paid for each Contract Year by the Participant to Supply System for the Participant's Share shall be the amount specified in the Billing Statement. The Participant shall make the payments to be made to Supply System under sections 5, 6 and 10, whether or not the Project is completed, operable or operating and notwithstanding the suspension, interruption, interference, reduction or curtailment of the Project output, and such payments shall not be subject to any reduction whether by offset or otherwise, and shall not be conditioned upon the performance or nonperformance by Supply System or the Administrator or any other Participant under this or any other agreement or instrument.

(b) *Assignment of Participant's Share to the Administrator.* The Participant hereby assigns and the Administrator hereby accepts the assignment of the Participant's Share. In consideration of such assignment, the Administrator shall provide to the Participant the payments, offsets, and credits specified in section 7 and section 10 in the manner provided therein, whether or not the Project is completed, operable or operating and notwithstanding the suspension, interruption, interference, reduction or curtailment of the Project output. Such payments, offsets, or credits to be made by the Administrator under this agreement shall not be reduced by offset or otherwise, except as specifically provided in section 7, and shall not be conditioned upon the performance or nonperformance by Supply System, the Participant or any Participant under this or any other agreement or instrument.

6. *Payment by the Participant.*

(a) Not less than 45 days prior to each Contract Year, or whenever the Annual Budget for such Contract Year is amended, Supply System shall prepare and deliver to the Participant and the Administrator a Billing Statement showing the amount to be paid by the Participant for such Contract Year.

Whenever during a Contract Year the Participant's Share changes from that used in preparing the Billing Statement for that Contract Year an amended Billing Statement shall be prepared for the remainder of that Contract Year reflecting such change and shall be submitted to the Participant and the Administrator.

(b) The Participant shall pay to Supply System each Contract Year the amount specified in the Billing Statement submitted under subsection (a) above. Such payments shall be made as specified below.

The Participant shall pay to Supply System each month in a Contract Year the amount by which the net billing credits and cash payments theretofore received from the Administrator by the Participant for that Contract Year under section 7 exceed the sum of the Participant's previous payments to Supply System for that Contract Year until the amount of the Billing Statement has been paid; *provided, however,* that in any event the Participant shall pay by the end of the last month in that Contract Year the amount by which the amount in the Billing Statement exceeds the total of the monthly amounts previously paid to Supply System by the Participant in such Contract Year.

Each such payment shall be made on or before the thirtieth day after (1) the date on each of the Administrator's bills to the Participant which reflects a credit to the Participant for such Contract Year pursuant to section 7(a) or (2) the date that payment is received from the Administrator pursuant to section 7(c). Amounts due and not paid by the Participant on or before the close of business of such thirtieth day shall bear an additional charge of two percent of the unpaid amount. Thereafter, a further charge of one percent of the initial amount remaining unpaid shall be added on the first day of each succeeding calendar month until the amount due is paid in full. Remittances received by mail will be accepted without assessment of the delayed payment charges referred to above provided the postmark indicates the payment was mailed on or before the thirtieth day after the date of the bill. If the thirtieth day after the date of the bill is a Sunday or other non-business day of the Participant, the next following business day shall be the last day on which payment may be mailed without addition of the delayed payment charge.

(c) In the event that Supply System bears any cost under section 10(e) of the Project Agreement the Participant will pay to Supply System an amount equal to the amount of such cost multiplied by the Participant's Share, in addition to the payments specified in section 6(b) hereof. Payments under this section 6(c) shall be made within 30 days from the date of mailing of the statement stating the amount of the payments.

7. *Payment by the Administrator.*

(a) For each Contract Year, the Administrator shall pay to the Participant an amount equal to that set forth in the Billing Statement for that Contract Year. The Administrator's payments shall be effected by means of credits against the Administrator's monthly billings to the Participant under the Participant's Bonneville Contracts, as follows:

(1) *For Contract Years in which this is the only agreement requiring the Administrator to make payments to the Participant*: In the month preceding each such Contract Year the Administrator shall allow a billing credit in the form of an offset to the Participant in the full amount of the Administrator's billings in that month under the Participant's Bonneville Contracts. A billing credit computed in the same manner shall be allowed in each of the succeeding months (except the last) in that Contract Year until the full amount owed by the Administrator for that Contract Year has been offset against the Administrator's billings to the Participant.

(2) *For Contract Years in which there are two or more agreements requiring the Administrator to make payments to the Participant*: In the month preceding each such Contract Year and in each of the succeeding months (except the last) in that Contract Year the Participant's billing credits under this agreement shall be offset in the manner specified in (1) above against the payments due from the Administrator under all agreements of the Participant requiring the Administrator to make payments to the Participant, in the proportion that the amount specified in the Billing Statement bears to the sum of the amounts to be paid by the Administrator under all such agreements for that Contract Year.

The total offsets allowed to the Participant hereunder for a Contract Year shall not exceed the sum of (1) the amount specified in the Billing Statement for that year and, (2) any amount paid by the Participant for a prior Contract Year which remains unpaid by the Administrator to the Participant under this agreement.

"Participant's Bonneville Contracts" as used in this section means all contracts or agreements between the Participant and the Administrator which require payments by the Participant to the

Administrator for sales and exchanges of power, operation and maintenance of facilities, use of transmission facilities, and emergency and standby power.

(b) If for any Contract Year, the Administrator determines that the dollar obligations due the Administrator from the Participant, referred to in subsection (a) above, are or are expected to be insufficient to offset the Administrator's dollar obligations to such Participant under subsection (a) above, and, in the opinion of the Administrator and the Participant, are expected to remain insufficient for a significant period, the Administrator shall use his best efforts to arrange for assignment of all or a portion of the Participant's Share and the associated benefits and obligations (subject to the prior assignment of the Participant's Share to the Administrator hereunder) to another customer or customers of the Administrator for all or a portion of the remaining term of this agreement to the extent required to eliminate the insufficiency, and the Participant shall make the assignment so arranged. The other Participants shall have first right to accept such assignment, pro rata among those exercising such right, before an assignment is made to a customer who is not one of the Participants. If the Administrator is unable to arrange for such assignment, the Participant shall make such assignment to the other Participants pro rata pursuant to the counterparts of subsection (f) of this section in the other Net Billing Agreements.

(c) If (1) assignments under subsection (b) cannot be made in amounts sufficient to bring into balance the respective dollar obligations of the Administrator and (2) an accumulated balance in favor of the Participant from a previous Contract Year is expected by the Administrator to be carried for an additional Contract Year, such balance and any subsequent monthly net balances that cannot be net billed shall be paid in cash to the Participant by the Administrator, subject to the availability of appropriations for such purposes.

(d) The Administrator and the Participant shall not enter into any agreements providing for payments to the Participant which the Administrator estimates will cause the aggregate of his billings to the Participant to be less than 115 percent of the Administrator's net billing obligations to the Participant under all agreements providing for net billing.

(e) If all or a portion of the Participant's Share is assigned under this section 7, the Participant shall nevertheless remain liable to Supply System to pay the purchase price for the Participant's Share in accordance with section 5(a) as if such assignment had not been made, and such liability of the Participant shall be discharged only to the extent that the assignee of the portion of the Participant's Share so assigned shall pay to Supply System the purchase price for the portion of the Participant's Share so assigned in accordance with the provisions of this agreement. Supply System may commence such suits, actions or proceedings, at law or in equity, including suits for specific performance, as may be necessary or appropriate to enforce the obligations of the Participant with respect to such liability.

(f) If assignments pursuant to section 7(b) of the other Net Billing Agreements cannot be made in amounts sufficient to balance dollar obligations of the Administrator and any other Participant, the Participant shall accept on a pro rata basis with other Participants assignment of a portion of such other Participant's Share, to the extent required to eliminate such insufficiency; *provided, however,* that the sum of such assignments to the Participant under this subsection shall not without the consent of the Participant exceed an accumulated maximum of 25 percent of the Participant's Share specified in Exhibit A, nor shall any such assignment under this subsection cause the estimate of the payments to be made by the Participant to Supply System under this agreement to exceed the estimate of the Administrator's billings to the Participant for each Contract Year during the period of such assignment, both such estimates to be made by the Administrator.

(g) The estimates by the Administrator under this agreement of billing credits and of payments to be made by the Participant and the Administrator giving rise to such billing credits shall be conclusive.

8. *Scheduling.* Prior to 4 p.m. on each work day beginning on the day preceding the Date of Commercial Operation (work day meaning a day which the Administrator and Supply System observe as a regular work day) the Administrator shall notify Supply System of the amounts of energy from the Project he will require for each hour of the following day or days; *provided, however,* the Administrator may during any hour request delivery of other amounts of energy. Supply System's dispatcher, within the capability of the Project and in accordance with Prudent Utility Practice, shall schedule for delivery to the Administrator at the point of delivery specified in section 11 for each hour in the term hereof the amounts of energy so requested by the Administrator.

9. *Participant's Right to Use Project Capability.*

(a) If the Administrator is unable to satisfy his obligation to the Participant by net billing, assignment or cash payment under section 7, and determines, in consultation with the Participant, that this inability will continue for a significant period, the Participant may direct that all or a portion of the energy associated with the Participant's Share be delivered by Supply System for the Participant's account at the point of delivery specified in section 11, for either the expected period of such inability or the remainder of the term hereof, whichever is specified by the Participant when it elects to have such energy delivered to it. The amount of such delivery shall be limited to the amount of the Participant's Share for which payment cannot be made, at the time the Participant elects to have such delivery made to it, by net billing with the Participant or assignees or by direct payment by the Administrator hereunder. The Participant's obligations to assign its Participant's Share to the Administrator and the Administrator's obligations to acquire such share and make payments to the Participant under this agreement shall then be appropriately modified. The Administrator's prior obligations to the Participant not previously liquidated pursuant to the terms of section 7 shall be preserved until satisfied.

(b) If the Participant elects to withdraw all or a portion of its Participant's Share as provided in this section, the Administrator will transmit such share to any point(s) of delivery on the Administrator's transmission system designated by the Participant where the Administrator determines such share can be made available, and will provide forced-outage reserves for such share, under the same terms and conditions as provided in contracts for similar service then being offered to other utilities in the Pacific Northwest owning interests in large thermal projects.

(c) Upon withdrawal of any portion of the Participant's Share under this section, the Participant shall schedule such portion in the same manner as provided for the Administrator in section 8, and the Administrator's rights under section 8 shall be correspondingly reduced.

Whenever the Participant schedules any portion of its Participant's Share, the Participant and the Administrator shall (1) schedule at least their respective proportionate shares of the minimum capability of the Project unless all Participants with similar obligations to schedule and the Administrator agree to a shutdown of the Project; *provided, however,* that the Administrator may, at his election, require shutdown of the Project if he supplies through exchange arrangements the power and energy the Participant otherwise would schedule from the Project during such period of shutdown, and (2) supply to the Supply System all necessary forecasts of their generation requirements from the Project for ensuing periods as necessary to enable the Supply System to prepare the fuel management plan pursuant to section 8 of the Project Agreement.

10. *Termination Settlements.*

(a) If the Project is ended pursuant to section 15 of the Project Agreement, Supply System shall give notice of termination of this agreement effective upon the date of termination of the Project Agreement. Supply System shall terminate all activities related to construction and operation of the Project, and shall undertake the salvage, discontinuance, decommissioning, and disposition or sale of the Project, as provided in the Project Agreement. After such termination, Supply

System shall make monthly accounting statements to the Administrator and the Participant of all costs associated therewith. Such monthly accounting statements shall continue until all Project Bonds have been paid or funds set aside for the payment or retirement thereof in accordance with the Project Bond Resolution or the final disposition of the Project, whichever is later, at which time a final accounting statement shall be made by Supply System and such final accounting statement shall be made at the earliest reasonable time. Such costs of salvage, discontinuance, decommissioning, and disposition or sale shall include, but shall not be limited to, all of Supply System's accrued costs and liabilities resulting from Supply System's ownership, construction, operation (including cost of fuel) and maintenance of and renewals and replacements to the Project, all other Supply System costs resulting from its ownership of the Project and the salvage, discontinuance, decommissioning, and disposition or sale thereof, and all amounts which Supply System is required under the Project Bond Resolution to pay in each year into the various funds provided in the Project Bond Resolution for debt service and all other purposes until the date that all of the Project Bonds shall have been paid or funds set aside for the payment or retirement thereof in accordance with the Project Bond Resolution.

The monthly accounting statements shall credit against such costs all amounts received by Supply System from the disposition of Project assets. The final accounting statement shall credit the fair market value of any assets related to the Project then retained by Supply System. If the monthly or final accounting statements show that such costs exceed such credits, the Participant shall pay Supply System at times reasonably agreed upon the sum determined by multiplying the amounts shown to be due in the monthly and final accounting statements by the decimal fraction then used in expressing the Participant's Share. In any case such payments shall be made at times and in amounts sufficient to cover on a current basis the Participant's Share of the amount which Supply System is required under the Project Bond Resolution to pay in each year into the various funds provided in the Project Bond Resolution for debt service and all other purposes. If the final accounting statement shows that such credits exceed such costs, Supply System shall pay at times reasonably agreed upon an amount determined by multiplying such excess by the Participant's Share, such amount to be divided between the Administrator and the Participant as their interests may appear. Such excess credits shall bear interest from the date of such final accounting statement to the date of payment, at the average of the annual interest rates for each month during such time for three-to-five year issues, United States Government securities (taxable), Money Market Rates, as published by the Board of Governors of the Federal Reserve System in the "Federal Reserve Bulletin" or equivalent publication or the maximum rate lawfully payable by Supply System, whichever is less.

(b) To the extent of the Participant's Share then assigned to the Administrator, the Administrator shall pay the Participant the amounts, if any, paid by the Participant to the Supply System pursuant to this section. Such amounts shall be paid in the manner specified in section 7 and at such times as the parties agree upon.

(c) The provisions of this section 10 and the provisions of sections 5(a) and 5(b) describing the circumstances under which payments are to be made in this section 10 and the provisions of section 13 shall remain in effect notwithstanding termination of this agreement pursuant to section 3.

11. *Provisions Relating to Delivery.* Deliveries of electric power and energy to the Administrator shall be made at the point of delivery and at the approximate voltage described in the exhibit specified below. Such electric power and energy shall be in the form of three-phase current, alternating at a frequency of approximately 60 Hertz. Amounts so delivered at such point during each month shall be determined from measurements made by Project meters, installed to record such deliveries at the place and in the circuit agreed upon by Supply System and the Administrator. Such point of delivery shall be described in a suitable exhibit to this agreement when the location, voltage, and metering details of the point of delivery are so agreed.

12. *Obligations in the Event of Default.* The Participant's Share purchased by the Participant from Supply System and assigned by the Participant to the Administrator under this agreement shall be automatically increased for the remaining term of this agreement pro rata with that of other nondefaulting Participants if, and to the extent that, one or more of the Participants is unable, or fails or refuses for any reason, to perform its obligations under its Net Billing Agreement, and the Participant's Share of the defaulting Participant shall be reduced correspondingly; *provided, however,* that the sum of such increases for the Participant pursuant to this subsection shall not, without consent of the Participant, exceed an accumulated maximum of 25 percent of the Participant's Share specified in Exhibit A, nor shall any such increase under this subsection cause the estimate of the payments to be made by the Participant to Supply System under this agreement to exceed the estimate of the Administrator's billings to the Participant during the period of such increase, which estimates shall be made by the Administrator and shall be conclusive.

If the Participant shall fail or refuse to pay any amounts due to Supply System hereunder, the fact that the other Participants have assumed the obligation to make such payments shall not relieve the Participant of its liability for such payments, and the Participants assuming such obligation, either individually or as a member of a group, shall have a right of recovery from the Participant. Supply System or any Participant as their interests may appear, jointly or severally, may commence such suits, actions or proceedings, at law or in equity, including suits for specific performance, as may be necessary or appropriate to enforce the obligations of this agreement against the Participant under this subsection.

13. *Sources of Participant's Payments.* The Participant shall not be required to make the payments to Supply System under this agreement except from the revenues derived by the Participant from the ownership and operation of its electric utility properties and from payments by the Administrator under this agreement.

The Participant covenants and agrees that it will establish, maintain and collect rates or charges for power and energy and other services, facilities and commodities sold, furnished or supplied by it through any of its electric utility properties which shall be adequate to provide revenues sufficient to enable the Participant to make the payments to be made by it to Supply System under this agreement and to pay all other charges and obligations payable from or constituting a charge and lien upon such revenues.

14. *Modification and Uniformity of Agreement.*

(a) This agreement shall not be binding upon any of the parties hereto if it is not binding upon all of the parties hereto, but this agreement shall not be subject to termination by any party under any circumstances, whether based upon the default of any other party under this agreement, or any other instrument, or otherwise, except as specifically provided in this agreement.

(b) This agreement shall not be amended, modified, or otherwise changed by agreement of the parties in any manner that will impair or adversely affect the security afforded by the provisions of this agreement for the payment of the principal, interest, and premium, if any, on the Project Bonds as they respectively become payable so long as any of the Project Bonds are outstanding and unpaid or funds are not set aside for the payment or retirement thereof in accordance with the Project Bond Resolution.

(c) If any Net Billing Agreement is amended or replaced so that it contains terms and conditions different from those contained in this agreement, the Administrator shall notify the Participant and upon timely request by the Participant shall amend this agreement to include similar terms and conditions.

15. *Assignment of Agreement.* This agreement shall inure to the benefit of and shall be binding upon the respective successors and assigns of the parties to this agreement; *provided, however,* that except as provided in sections 7, 9 and 12 hereof, neither this agreement nor any interest therein shall

be transferred or assigned by any one of the parties hereto except with the mutual consent in writing of the other two parties hereto, to any other entity except the United States or an agency thereof. Such consent will not be unreasonably withheld. No assignment or transfer of this agreement shall relieve the parties of any obligation hereunder.

16. *Approval by Rural Electrification Administrator.* If the Participant is a party to an agreement or other instrument pursuant to which approval of this agreement by the Administrator of the Rural Electrification Administration is required as listed in Exhibit A, this agreement shall not be binding upon any of the parties until it shall have been approved by him or his delegate.

17. *Participants' Review Board.*

(a) *Composition; election.* Not more than 30 days after the execution of this agreement, and thereafter not less than 60 days prior to the commencement of each Contract Year, the Participants shall elect a Participants' Review Board consisting of nine members. Supply System shall give each Participant not less than 15 days' written notice stating the time and place at which a meeting of representatives of the Participants shall be held for the purpose of holding such election. Each Participant shall designate the person and an alternate (to serve in the absence or disability of such person), to cast its vote(s) for Board members by written notice filed with Supply System. The vote cast in behalf of each Participant shall be proportional to its Participant's Share. Any vacancy on the Board shall be filled by vote of the remaining Board members pending the next Board election.

(b) *Board meetings; voting; and rules.* Meetings of the Participants' Review Board shall be held at least quarterly during the construction of the Project and at least semi-annually thereafter. Timely written notice of the time and place of such meeting shall be given to the parties. Each member of the Board shall be entitled to one vote, to be cast in person and not by proxy. A majority of the Board shall constitute a quorum, and the majority of those present shall be necessary and sufficient for the adoption of any motion or resolution except as otherwise provided in subsection (e) below. All meetings of the Board shall be open to attendance by any person authorized by any of the Participants. Except as herein provided, the calling and holding of meetings of the Board, and all of its other proceedings, shall be governed by rules adopted from time to time by two-thirds of the entire membership of the Board which rules may provide that Board shall have the right to appoint persons of technical, legal, auditing or other special qualifications to committees to carry out reviews and investigations.

(c) Copies of all Construction and Annual Budgets and Fuel Management Plans, including amendments thereto, and plans for refinancing the Project shall be submitted by Supply System to the Participants' Review Board. Such copies shall be submitted to the Participant upon its request.

(d) Except in the event of an emergency requiring immediate action, all bids, bid evaluations and proposed contract awards for amounts in excess of $500,000 shall be submitted to the Participants' Review Board at least seven days prior to award.

(e) Supply System will consider the recommendations of the Participants' Review Board, giving due regard to utilizing the Project consistent with Prudent Utility Practice and the Supply System's statutory duties. Written recommendation may be made to Supply System whenever such recommendation is approved by the majority of the members of the Participants' Review Board. Such written recommendations shall be forwarded to Supply System within a reasonable time along with supporting data, which time shall not exceed the comparable time, if any, prescribed in the Project Agreement. Supply System shall take action on such recommendations within a reasonable time for adoption, modification or rejection. Supply System, upon taking action, shall notify the Participants' Review Board promptly of such action, and, if it modifies or rejects a recommendation, shall give the reason therefor.

(f) If Supply System modifies or rejects a written recommendation of the Participants' Review Board concerning a matter submitted for review under subsections (c) or (d) above, the Participants' Review Board may refer the matter to the Project Consultant in the manner described in section 10 of the Project Agreement for his written decision and his decision shall be binding upon the parties. Pending any decision by the Project Consultant under this subsection, Supply System shall proceed in accordance with the Project Agreement. Nothing in this subsection shall affect the procedure for the settlement of any dispute between the Administrator and the Supply System under this agreement or the Project Agreement.

(g) Supply System shall not proceed with any item as proposed by it in accordance with section 10(e) of the Project Agreement without approval of the Participants' Review Board.

(h) Recognizing that at the time of the execution of this agreement the availability of insurance may be limited, if a second unit or generating project is proposed for the site of the Project, Supply System shall not, without the consent of the Administrator and the Participants' Review Board, cause the insurance on the Project to be extended to such unit or generating project nor lapse to permit the extension of such coverage.

18. *Applicability of Other Instruments.* It is recognized by the parties hereto that Supply System in the ownership, construction and operation of the Project must comply with the requirements of the Project Bond Resolution and all licenses, permits, and regulatory approvals necessary for such ownership, construction and operation, and it is, therefore, agreed that this agreement is made, and referrals to the Project Consultant hereunder shall be, subject to the terms and provisions of the Project Bond Resolution and all such licenses, permits, and regulatory approvals.

IN WITNESS WHEREOF, the parties hereto have executed this agreement in several counterparts.

UNITED STATES OF AMERICA
Department of the Interior

(SEAL)

By /s/ H. R. RICHMOND
Bonneville Power Administrator

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

(SEAL)

By /s/ OWEN W. HURD

ATTEST:

/s/ EDWIN W. TAYLOR

(THE PARTICIPANT'S NAME)

(SEAL)

By................................

ATTEST:

....

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EXHIBIT A

TABLE OF PARTICIPANTS AND PARTICIPANT'S SHARE

Participant	Participant's Share
City of Albion, Idaho	.00000
City of Bandon, Oregon	.00263
Public Utility District No. 1 of Benton County, Washington	.05350
*Benton Rural Electric Association, Inc	.00666
*Big Bend Electric Cooperative, Inc.	.01610
*Blachly-Lane County Cooperative Electric Association	.00272
City of Blaine, Washington	.00185
City of Bonners Ferry, Idaho	.00000
City of Burley, Idaho	.00000
City of Canby, Oregon	.00090
City of Cascade Locks, Oregon	.00054
*Central Electric Cooperative, Inc.	.00586
City of Centralia, Washington	.00739
Central Lincoln Peoples' Utility District	.04017
City of Cheney, Washington	.00539
Public Utility District No. 1 of Clallam County, Washington	.01769
Public Utility District No. 1 of Clark County, Washington	.06834
Clatskanie Peoples Utility District	.01996
*Clearwater Power Company	.00775
*Columbia Basin Electric Cooperative, Inc.	.00673
*Columbia Power Cooperative Association, Inc.	.00143
*Columbia Rural Electric Association, Inc.	.00761
*Consumers Power, Inc.	.00453
*Coos-Curry Electric Cooperative, Inc.	.01634
City of Coulee Dam, Washington	.00137
Public Utility District No. 1 of Cowlitz County, Washington	.06139
City of Declo, Idaho	.00000
*Douglas Electric Cooperative, Inc.	.00363
City of Drain, Oregon	.00218
East End Mutual Electric Co., Ltd.	.00033
City of Ellensburg, Washington	.01028
*Fall River Rural Electric Cooperative, Inc.	.00409
Farmers Electric Co., Ltd.	.00041
*Public Utility District No. 1 of Ferry County, Washington	.00171
*Flathead Electric Cooperative, Inc.	.00370
City of Forest Grove, Oregon	.00181
Public Utility District No. 1 of Franklin County, Washington	.02370
Public Utility District No. 1 of Grays Harbor, Washington	.03417
*Harney Electric Cooperative, Inc.	.00719
City of Heyburn, Idaho	.00000
Hood River Electric Cooperative of Hood River County, Oregon	.00502
*Idaho County Light & Power Cooperative Association, Inc.	.00186
City of Idaho Falls, Idaho	.00000
*Inland Power & Light Company	.01222
*Public Utility District No. 1 of Kittitas County, Washington	.00220

*Approval of Agreement by Rural Electrification Administration required.

Participant	Participant's Share
*Public Utility District No. 1 of Klickitat County, Washington	.01009
*Kootenai Electric Cooperative, Inc.	.00391
*Lane County Electric Cooperative, Inc.	.01452
Public Utility District No. 1 of Lewis County, Washington	.02274
*Lincoln Electric Cooperative, Inc. (Montana)	.00255
*Lost River Electric Cooperative, Inc.	.00202
*Lower Valley Power & Light, Inc.	.00820
*Public Utility District No. 1 of Mason County, Washington	.00231
Public Utility District No. 3 of Mason County, Washington	.01446
Town of McCleary, Washington	.00234
City of McMinnville, Oregon	.01227
*Midstate Electric Cooperative, Inc.	.00488
City of Milton-Freewater, Oregon	.00583
City of Minidoka, Idaho	.00000
*Missoula Electric Cooperative, Inc.	.00294
City of Monmouth, Oregon	.00236
*Nespelem Valley Electric Cooperative, Inc.	.00149
*Northern Lights, Inc.	.00455
Northern Wasco County People's Utility District	.00051
*Okanogan County Electric Cooperative, Inc.	.00190
*Public Utility District No. 1 of Okanogan County, Washington	.01042
*Orcas Power and Light Company	.00725
Public Utility District No. 2 of Pacific County, Washington	.01503
City of Port Angeles, Washington	.02416
*Prairie Power Cooperative, Inc.	.00019
*Raft River Rural Electric Cooperative, Inc.	.00853
*Ravalli County Electric Cooperative, Inc.	.00301
City of Richland, Washington	.02761
Riverside Electric Company, Ltd.	.00020
City of Rupert, Idaho	.00000
Rural Electric Company	.00262
Salem Electric	.00453
[illegible] Electric Cooperative, Inc.	.00170
[illegible] Washington	.07992
[illegible] No. 1 of Skamania County, Washington	.00547
[illegible] No. 1 of Snohomish County, Washington	.17069
[illegible] Lines, Inc.	.00073
[illegible] Oregon	.00363
[illegible] Washington	.00048
[illegible]rification Corporation	.00323
[illegible] Washington	.00000
[illegible]	.00122
[illegible] Utility District	.01729
[illegible] operative Association	.00036
[illegible]er Company	.00204
[illegible]ict No. 15	.00701
[illegible] Cooperative, Inc.	.00294
[illegible] No. 1 of Wahkiakum County, Washington	.00328
[illegible]erative, Inc.	.00342
[illegible]c Cooperative, Inc.	.00182
	1.00000

*[illegible] by Rural Electrification Administration required.

If, prior to January 1, 1978, the Attorney General of the State of Idaho shall render an opinion, concurred in by Supply System's Bond Counsel, affirming the legal authority of the Participants listed in Group I below, to participate in the Project on the terms and conditions specified in this agreement, a new Exhibit A shall be prepared by Supply System and forthwith shall be substituted for this Exhibit A specifying the Participant's Share in the amount shown for each of the Participants listed below in Groups I and II:

Group I:

Participant	Participant's Share
City of Albion, Idaho	.00016
City of Bonners Ferry, Idaho	.00182
City of Burley, Idaho	.00694
City of Declo, Idaho	.00019
City of Heyburn, Idaho	.00504
City of Idaho Falls, Idaho	.02376
City of Minidoka, Idaho	.00005
City of Rupert, Idaho	.00348

Group II:

Participant	Participant's Share
Public Utility District No. 1 of Clark County, Washington	.06151
Public Utility District No. 1 of Cowlitz County, Washington	.05525
Public Utility District No. 1 of Grays Harbor, Washington	.03075
City of Seattle, Washington	.07193
Public Utility District No. 1 of Snohomish County, Washington	.15363

This Exhibit A may be further amended from time to time prior to the adoption of the Project Bond Resolution which authorizes the issuance of Project Bonds in an amount sufficient to finance the cost of construction of the Project. In such event, a new Exhibit A shall be prepared by Supply System and forthwith shall be substituted for this Exhibit A upon mutual agreement of the Participants listed in Group II above or upon mutual agreement of such Participants and one or more of the other Participants so as to reduce the Participant's Share of one or more of the Participants listed in Group II above and increase the Participant's Share(s) of the other agreeing Participant(s) so that the aggregate of the increases is equal to the aggregate of the decreases; *provided, however,* that any such amendment shall be made only after first complying with the conditions prescribed in Paragraph C, Section 11, of the Project Bond Resolution authorizing the issuance of Washington Public Power Supply System Nuclear Project No. 2 Revenue Notes.

EXHIBIT B

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 2

Description of Project

The Washington Public Power Supply System's Nuclear Project No. 2 is expected to have a net electrical plant capability of approximately 1100 MW.

The site is located in the Federal reservation known as the Hanford Works of the U. S. Atomic Energy Commission. The site is near the Columbia River approximately 35 miles northwest of the City of Richland, Washington.

The plant and associated facilities will include a nuclear steam supply system, fuel and reactor coolant system with all related containment structures, safety features, instrumentation, control and auxiliary systems; turbine-generator, condensers and circulating water cooling systems, facilities and piping; electrical and mechanical systems and other related equipment and facilities; electrical facilities required to deliver the output of the project to the BPA transmission system at a point to be determined by the System and the Administrator; and other structures, shops, warehouses, construction facilities, offices, equipment or facilities required in the construction, maintenance and operation of the project.

A complete description of the project will be prepared after bids have been received and evaluated and awards have been made for major plant components.

PROVISIONS REQUIRED BY STATUTE OR EXECUTIVE ORDER

1. *Contract Work Hours and Safety Standards.*

This contract, to the extent that it is of a character specified in the Contract Work Hours and Safety Standards Act (Public Law 87-581, 76 Stat. 357-360, as amended) and is not covered by the Walsh-Healey Public Contracts Act (41 U. S. C. 35-45), is subject to the following provisions and to all other provisions and exceptions of said Contract Work Hours and Safety Standards Act.

(a) No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any laborer or mechanic in any workweek in which he is employed on such work, to work in excess of eight hours in any calendar day or in excess of forty hours in any workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of eight hours in any calendar day or in excess of forty hours in such workweek, whichever is the greater number of overtime hours.

(b) In the event of any violation of the provisions of subsection (a), the Contractor and any subcontractor responsible for such violation shall be liable to any affected employee for his unpaid wages. In addition, such Contractor or subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed, with respect to each individual laborer or mechanic employed in violation of the provisions of subsection (a), in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of eight hours or in excess of forty hours in a workweek without payment of the required overtime wages.

(c) The Administrator may withhold, or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor, the full amount of wages required by this contract and such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for liquidated damages as provided in subsection (b).

(d) No contractor or subcontractor contracting for any part of the contract work shall require any laborer or mechanic employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation based on proceedings pursuant to section 553 of title 5, United States Code, provided that such proceedings include a hearing of the nature authorized by said section.

(e) The Contractor shall require the foregoing subsections (a), (b), (c), (d) and this subsection (e) to be inserted in all subcontracts.

(f) The Contractor shall keep and maintain for a period of three (3) years from the completion of this contract the information required by 29 CFR § 516.2(a). Such material shall be made available for inspection by authorized representatives of the Government, upon their request, at reasonable times during the normal work day.

2. *Convict Labor.*

The Contractor shall not employ any person undergoing sentence of imprisonment at hard labor.

3. *Equal Opportunity.*

Unless exempted pursuant to the provisions of Executive Order 11246 of September 24, 1965 and the rules, regulations and relevant orders of the Secretary of Labor thereunder, during the performance of this contract, the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Administrator setting forth the provisions of this equal opportunity clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Administrator, advising the labor union or worker's representative of the Contractor's commitments under this equal opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Administrator and the Secretary of Labor for purposes of investigations to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Contractor's noncompliance with the equal opportunity clause of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Administrator may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however,* that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Administrator, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

4. *Interest of Member of Congress.*

No Member of or Delegate to Congress, or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise therefrom. Nothing, however, herein contained shall be construed to extend to such contract if made with a corporation for its general benefit.

EXHIBIT IV

Contract No. 14-03-19121

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PROJECT NO. 2

AGREEMENT

executed by the

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR

acting by and through the

BONNEVILLE POWER ADMINISTRATOR

and

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

(Project Agreement)

INDEX TO SECTIONS

This **AGREEMENT,** executed January 4, 1971, by the UNITED STATES OF AMERICA (hereinafter called "the Government"), Department of the Interior, acting by and through the BONNEVILLE POWER ADMINISTRATOR (hereinafter called "the Administrator"), and WASHINGTON PUBLIC POWER SUPPLY SYSTEM (hereinafter called "Supply System"), a municipal corporation of the State of Washington,

WITNESSETH:

WHEREAS, the Administrator has determined that acquisition of the Project Capability of the Washington Public Power Supply System Nuclear Project No. 2 to be financed, constructed, owned and operated by Supply System as herein provided will assist in attaining the objectives of the Bonneville Project Act, and other statutes pertaining to the disposition of electric power and energy from Government projects in the Pacific Northwest by enabling the Government to make optimum use of the Federal Columbia River Power System, and that the integration of the capability of the Project with the hydroelectric resources of the Federal Columbia River Power System as provided herein will enable the Administrator to make available additional firm power and energy to meet the needs of his customers; and

WHEREAS, in order to achieve the economies of size for the benefit of its members and the Participants, Supply System proposes to plan, finance, construct, acquire, operate, own and maintain the Project; and

WHEREAS Supply System expects to lease a parcel of land within the Hanford Project Reservation of the U.S. Atomic Energy Commission in Benton County, State of Washington, as the site for such nuclear plant known as "Washington Public Power Supply System Nuclear Project No. 2," and Supply System expects, in connection therewith, to enter into certain contracts for the financing, planning, engineering and construction, and operation of said plant; and

WHEREAS Supply System, the Administrator, and the Participants are parties to Net Billing Agreements under which Supply System sells Project Capability to the Participants and under which the Administrator will acquire Project Capability from the Participants; and

WHEREAS Supply System is organized under the laws of the State of Washington (Rev. Code of Washington, Ch. 43.52, cum supp.) and is authorized by law to construct, acquire and operate works, plants, and facilities for the generation and/or transmission of electric power and energy and to enter into contracts with the Administrator and public and private organizations for the disposition and distribution of electric energy produced thereby; and

WHEREAS the Administrator is authorized pursuant to law to dispose of electric power and energy generated at various federal hydroelectric projects in the Pacific Northwest and to enter into related agreements;

NOW, THEREFORE, the parties do hereby mutually agree as follows:

1. *Definition and Explanation of Terms.*

(a) "Annual Budget" means the budget adopted by Supply System not less than 45 days prior to the beginning of each Contract Year which itemizes the projected costs of the Project applicable to such Contract Year, or, in the case of an amended Annual Budget, applicable to the remainder of such Contract Year. The Annual Budget, as amended from time to time, shall make provision for all of Supply System's costs, including accruals and amortizations, resulting from the ownership, operation (including cost of fuel), and maintenance of the Project and repairs, renewals, replacements, and additions to the Project, including, but not limited to, the amounts which Supply System is required under the Project Bond Resolution to pay in each Contract Year into the various funds provided for in the Project Bond Resolution for debt service and all other purposes; *provided,* *however,* that the Annual Budget for any portion of a Contract Year prior to the Date of Commercial Operation or September 1, 1977, whichever occurs first, shall include only such amounts as may be agreed upon by Supply System and the Administrator.

(b) "Contract Year" (1) means the period commencing on the Date of Commercial Operation, or on January 1, 1977, whichever occurs first, and ending at 12 p.m. on the following June 30, and (2) thereafter means the 12-month period commencing each year at 12 p.m. on June 30, except that the last Contract Year shall end on the date of termination of this agreement.

(c) "Construction Budget" means the budget adopted by Supply System which sets forth an estimated schedule of construction expenditures and itemizes all costs related to ownership, design, planning, construction and financing of the Project, as well as any amendments thereto during the course of construction.

(d) "Date of Commercial Operation" means the date fixed by the parties as the point in time when the generating plant is ready to be operated on a commercial basis pursuant to schedules agreed to by the Administrator and Supply System.

(e) "Net Billing Agreements" means the agreements for the Project entered into by Supply System, each of the Participants and the Administrator (designated as Contracts No. 14-03-19122 through 14-03-19216, inclusive).

(f) "Participants" means those entities which are specified in Exhibit A of the Net Billing Agreements, or which become assignees of all or part of any Participant's Share pursuant to the Net Billing Agreements.

(g) "Project" means the nuclear generating plant and related properties as described in Exhibit A. Said Exhibit A shall be revised from time to time by mutual agreement of the parties, but in any event shall conform to the description of the Project in the Project Bond Resolution which authorizes the issuance of Project Bonds in an amount sufficient to pay the costs of acquiring and constructing the Project.

(h) "Project Bonds" means any bond, bonds, or other evidences of indebtedness issued in connection with the Project pursuant to the Project Bond Resolution (1) to finance or refinance Supply System's costs associated with planning, designing, financing, acquiring and constructing the Project pursuant to the Project Bond Resolution and (2) for any other purpose authorized thereby.

(i) "Project Bond Resolution" means the resolution or resolutions adopted or supplemented by Supply System, as the same may be amended or supplemented, to authorize the Project Bonds.

(j) "Project Consultant" means an individual or firm, of national reputation having demonstrated expertise in the field of the matter or item referred to it, appointed among other things, for the resolution of a difference regarding a matter or item referred by Supply System. A different Project Consultant may be appointed for each matter or item referred.

(k) "Prudent Utility Practice" at a particular time means any of the practices, methods, and acts engaged in or approved by a significant proportion of the electrical utility industry prior to such time, or any of the practices, methods, and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at the lowest reasonable cost consistent with reliability, safety and expedition. Prudent Utility Practice shall apply not only to functional parts of the Project but also to appropriate structures, landscaping, painting, signs, lighting, and other facilities and public relations programs reasonably designed to promote public enjoyment, understanding and acceptance of the Project and to other activities relating to the statutory responsibilities and duties of Supply System. Prudent Utility Practice is not intended to be limited to the optimum practice, method or act, to the exclusion of all others, but rather to be a spectrum of possible practices, methods or acts. In evaluating whether any act or proposal conforms to Prudent Utility Practice, the parties and any Project Consultant shall take into account the objective to integrate the entire Project Capability with the hydroelectric resources of the Federal Columbia River Power System and to achieve optimum utilization of the resources of that system taken as a whole, and to achieve efficient and economical operation of that system.

2. *Exhibits.* Exhibits A and B are by this reference incorporated herein and made a part of this agreement. Supply System shall be the "Contractor" as that term is used in Exhibit B.

3. *Term of Agreement.* This agreement shall be effective upon execution and delivery and shall terminate when the Project terminates as provided in section 15.

4. *Design, Licensing and Construction of the Project.*

(a) Supply System shall perform its duties and exercise its rights under this agreement in accordance with Prudent Utility Practice.

(b) Supply System shall seek and use its best efforts to obtain all licenses, permits and other rights and regulatory approvals necessary for the ownership, construction, and operation of the Project.

(c) Supply System shall complete all appropriate planning and engineering studies and construct the Project in accordance with Prudent Utility Practice. Supply System shall use its best efforts to schedule the Date of Commercial Operation to be, as near as may be, September 1, 1977.

(d) Supply System shall keep the Administrator informed of all matters Supply System deems significant with respect to planning, engineering studies and construction of the Project, where practicable in time for the Administrator to comment thereon before decisions are made. Upon request by the Administrator, Supply System shall furnish or make available to the Administrator with reasonable promptness, and at reasonable times, copies of proposed plans, specifications, invitations for bids and contracts and all certificates delivered to Supply System by any engineer or architect in connection with such construction, and all bids, papers, records and accounts relating to construction or operation of the Project.

(e) Supply System shall award separate contracts for readily separable parts of the work to the extent consistent with construction of the Project at the least overall cost and the high quality required. Construction contracts may be lump sum or unit price, and may also contain incentive and liquidated damage causes. Supply System shall advertise for bids among qualified contractors and award the contract after appropriate evaluation and review to the lowest responsible and responsive bidder, or reject all bids. All bids, bid evaluations, and proposed contract awards for amounts in excess of $500,000 shall be submitted to the Administrator prior to contract award. If the Administrator disapproves the proposed award, the matter will be referred to the Project Consultant as provided in section 10.

(f) The Administrator may, at his option and at Government expense, maintain a representative at the Project site during the construction of the Project. Such representative shall have no authority regarding administration or inspection of the Project construction.

(g) Notwithstanding any other provisions of this agreement, the selection of the (1) type and specifications for the nuclear steam supply system, (2) method of cooling, (3) the specifications for the turbine-generator, (4) architect-engineer, and (5) any change in site location shall be made only after approval by the Administrator.

(h) The Administrator shall use his best efforts to construct, operate and maintain necessary facilities to interconnect the Project with the Government's transmission grid so as to be ready to receive Project generation on or before the initial test and operation of the Project, presently scheduled for April 1, 1977.

(i) The Administrator shall have the right to purchase upon reasonable terms and conditions energy produced during any test operation of the generating unit of the Project, upon reasonable notice to Supply System of his intention to do so, given prior to the commencement of such test operation. If the Administrator does not exercise such right, he shall accept delivery into the Federal Columbia River Transmission System and, upon reasonable terms and conditions, shall deliver any such energy not purchased by him to Supply System or its assignee at mutually agreed points.

5. *Financing the Project.*

(a) Supply System shall, in good faith and with due diligence, use its best efforts to issue and sell Project Bonds to finance the costs of the Project and the completion thereof, as such costs are defined in the Project Bond Resolution and, subject to the provisions of section 11(c), to finance the costs of any capital additions, renewals, repairs, replacements, or modifications to the Project; *provided, however,* that in each such case such Project Bonds may then be legally issued and sold.

Supply System may, after submitting its financing proposal to the Administrator, or shall, whenever requested by the Administrator, adopt proceedings to authorize the issuance and sale of additional Project Bonds to refund outstanding Project Bonds prior to maturity in accordance with the Project Bond Resolution; *provided, however,* if in the judgment of Supply System or the Administrator no substantial benefits or economies will be achieved by such refunding the matter shall be referred to the Project Consultant as provided in section 10.

(b) Notwithstanding any other provisions of this agreement, the Project Bond Resolution shall be subject to the approval of the Administrator.

6. *Budget and Accounting Procedures.*

(a) *Construction Budget.* The Administrator has heretofore reviewed Supply System's Construction Budget in connection with the Project. By October 1 of each year until completion of construction of the Project Supply System shall prepare and submit to the Administrator an updated Construction Budget describing the items of construction and the estimated amounts to be expended therefor in each quarter from the succeeding January 1 to estimated date of Project completion. Supply System shall submit revised Construction Budgets to the Administrator from time to time to reflect substantial changes in construction schedules, plans, specifications, or costs. Updated Construction Budgets for the succeeding calendar year and revised Construction Budgets for the current calendar year shall become effective unless disapproved by the Administrator within 30 days, and seven days, respectively, after submittal. Any item disapproved shall be referred to the Project Consultant as provided in section 10.

A monthly Construction Budget report shall be prepared by Supply System and filed with the Administrator showing by major plant accounts or contracts, the cumulative amounts committed and the cumulative expenditures to date of each such report.

(b) *Annual Budget.* At least 90 days prior to the expected Date of Commercial Operation, Supply System shall submit to the Administrator a proposed Annual Budget for the period from the expected Date of Commercial Operation to the next succeeding July 1, and if the Date of Commercial Operation occurs subsequent to April 1 in a calendar year, a similar Annual Budget for the next succeeding Contract Year. Thereafter, on or before April 1 of each year Supply System shall submit to the Administrator a similar Annual Budget for the next succeeding Contract Year, which budget shall take into account the cumulative difference between income and expenditures for the prior Contract Year and provide for adjustment, as necessary, of the appropriate working cash fund.

All taxes imposed and required by law to be paid, and which are due and payable in a Contract Year, shall be included in the Annual Budget for that Contract Year as a Project Cost. To the extent Supply System is permitted by law to negotiate for payments in lieu of taxes or other negotiated payments to state or local taxing entities, the Annual Budget shall also include the amounts of such negotiated payments: *provided, however,* that Supply System shall not agree to such a negotiated payment if in any Contract Year the sum of such negotiated payments and taxes imposed by law would exceed the total amount of ad valorem taxes that Supply System would have paid in that year to such taxing entities if the Project or portion thereof, within the boundaries of each such taxing entity, were subject to ad valorem taxes and its valuation for tax purposes were added to the valuation of the property subject to ad valorem taxes by such taxing entity, but with its millage rate reduced so that the amount of ad valorem taxes raised would be unchanged.

Notwithstanding any other provision of this agreement, costs incurred by Supply System in an emergency or to protect the safety of the Project or the public shall be added to the Annual Budget as incurred. Promptly after any such occurrence, and prior to expenditures of any other funds not contemplated in the effective Annual Budget, Supply System shall submit a revised Annual Budget to the Administrator.

The Annual Budget and revised Annual Budget shall become effective unless disapproved by the Administrator within 30 days and seven days, respectively, after submittal. Any item disapproved shall be referred to the Project Consultant as provided in section 10.

(c) *Accounting.* Supply System shall keep up-to-date books and records showing all financial transactions and other arrangements made in carrying out the terms of this agreement. Such books and records shall contain information supporting the allocation of Supply System's indirect costs associated with the Project, and the method of allocating or prorating costs or expenses as between the Project and other activities in which Supply System may have an interest shall be based upon Prudent Utility Practice. Such books and records shall be retained by Supply System for three years and shall be made available for inspection and audit by the Administrator at any reasonable time.

All accounts shall be kept so as to permit conversion to the system of accounts prescribed for electric utilities by the Federal Power Commission.

Any contract with any consultant or contractor of Supply System providing for reimbursement of costs or expenses of any kind shall require the keeping and maintenance of books, records, documents, and other evidence pertaining to the costs and expenses incurred or claimed under such contract to the extent and in such detail as will properly reflect all costs related to this agreement and shall require such books, records, documents and evidence to be made available to the Administrator at all reasonable times for review and audit for a period of three years after final settlement of the applicable contracts.

7. *Operation and Maintenance of the Project.*

(a) Supply System shall operate and maintain the Project in accordance with Prudent Utility Practice and so as to meet the requirements of the Atomic Energy Commission, and other government agencies having jurisdiction.

(b) During any hour in which the Project does not generate power for station use and losses to the high voltage terminals of the Project substation, the Administrator shall furnish such power to the Supply System at the point of delivery specified in section 11 of the Net Billing Agreements; *provided, however,* that deliveries of such power may be interrupted or reduced in the case of system emergencies, or in order to make repairs, replacements or necessary additions to or perform maintenance on that portion of the Federal Columbia River Power System necessary to provide such power.

8. *Fuel.*

(a) At least 60 days prior to the anticipated date of award of the initial fuel contract, and annually thereafter until the Date of Commercial Operation, Supply System shall prepare and submit a fuel management plan ("Plan") to the Administrator. Each year thereafter, the Plan shall be submitted with each Annual Budget beginning with the first such Annual Budget. The Supply System shall amend the Plan as reasonably required to reflect changes in conditions unforeseen at the time the Plan was prepared.

Supply System shall consult with the Administrator in the preparation of the initial and each subsequent Plan. The Administrator shall furnish Supply System all necessary forecasts of the generation requirements of the Project. Such forecasts shall indicate the manner in which the Project is to be operated to integrate and coordinate the Project with hydroelectric and other thermal resources available to the Administrator. Supply System shall rely upon such forecasts in preparing the Plan.

The Plan shall cover a period of at least the next succeeding ten years. It shall include a cash flow analysis of forecasted expenditures and credits for each major component of the fuel cycle, by years, for the entire period, and cash flow by months, for the first five years of the period. The Plan shall also include, but shall not be limited to, forecasts of the dates and details of fueling outages, contracts for each component of the fuel cycle, shipments and any licenses or permits required therefor and any other pertinent actions.

Each Plan, any changes therein, and costs relating thereto shall become effective unless disapproved by the Administrator within 30 days after submittal; *provided, however,* whenever in his judgment it is practical to do so the Administrator shall notify Supply System in writing within ten days after each such submittal of his approval or disapproval. Any matter or item disapproved shall be referred to the Project Consultant as provided in section 10.

(b) At the time of each fueling, Supply System shall prepare in consultation with the Administrator and furnish to the Administrator its best estimate of the kilowatt-hours of net energy available from the Project to the next scheduled fueling date and the estimated fixed and variable unit cost per net kilowatt-hour and furnish to the Administrator such other data as may be requested by the Administrator. Supply System shall review the data with the Administrator at least monthly and revise such data as necessary.

9. *Permits.* Subject to any regulations of the Atomic Energy Commission pertaining to the Project, if by the terms of this agreement any equipment or facility of either party is, or is to be, located on the property of the other, a permit to install, test, maintain, inspect, replace, and repair during the term of this agreement and to remove at the expiration of said term such equipment and facility, together with the right of ingress to and egress from the location thereof at all reasonable times in such term, is hereby granted by the other party.

10. *Administrator's Approval and Project Consultant.*

(a) All proposals of Supply System, including but not limited to, budgets, plans, actions, activities, or matters submitted to the Administrator under any provisions of this agreement shall include itemized cost estimates and other detail sufficient to support a comprehensive review, including but not limited to, a copy of all supporting reports, analyses, recommendations, or other documents pertaining thereto. If the Administrator does not disapprove the proposal within the time specified, or if no time is specified, within seven days after receipt, the proposal shall be deemed approved. Any proposal disapproved shall be segregated so that exact items of difference are identified and shall become effective immediately as to items not disapproved.

(b) Except as provided in sections 4(g), 5(b), 11(b), and the third paragraph of section 6(b), disapproval by the Administrator shall be given in writing and shall be based solely on whether the proposal or item is consistent with Prudent Utility Practice. Such disapproval shall describe in what particular the proposal or item is not consistent with Prudent Utility Practice and shall at the same time recommend what would meet that standard.

When any proposal or item is so disapproved by the Administrator, Supply System shall adopt the suggestion of the Administrator or within seven days after receipt of such disapproval, shall appoint a Project Consultant acceptable to the Administrator to review the proposal or item in the manner described in this section. If the parties shall not agree upon the selection of the Project Consultant, Supply System shall promptly request the Chief Judge of the United States District Court for the Western District of Washington to appoint the Project Consultant.

(c) The Project Consultant shall consider all written arguments and factual materials which have been submitted to it by either party within the ten days following its appointment, and as promptly as possible after the expiration of such period, make a written determination as to whether the proposal or item disapproved by the Arministrator referred to it by Supply System would or would not have been consistent with Prudent Utility Practice. If the Project Consultant determines that the proposal or item referred to it was not consistent with Prudent Utility Practice it shall, at the same time, recommend what would, under the same circumstances, have met such test.

Proposals or items found by the Project Consultant to be consistent with Prudent Utility Practice shall become immediately effective. Proposals or items found by the Project Consultant to be inconsistent with Prudent Utility Practice shall be modified to conform to the recommendation of the Project Consultant or as the parties otherwise agree and shall become effective as and when modified.

(d) All costs incurred by Supply System for or by reason of employing a Project Consultant under this agreement and the Net Billing Agreements shall be a cost of the Project.

(e) If any proposal or item referred to the Project Consultant has not been resolved and will affect the continuous operation of the Project, Supply System shall continue to operate the Project. Supply System may proceed with the item, (1) as proposed by it, or (2) as proposed by the Administrator, or (3) as modified by mutual agreement by Supply System and the Administrator prior to the time such item affects operation of the Project; *provided, however,* if Supply System proceeds with the item as proposed by it and that item is determined by the Project Consultant to be inconsistent with Prudent Utility Practice, Supply System shall bear any net increase in the cost of construction or operation of the Project resulting from such item without charge to the Project to the extent such item was inconsistent with what the Project Consultant determined would under such circumstances have met such test. Notwithstanding other provisions of this section 10(e), whenever a proposal has been referred to the Project Consultant, Supply System shall operate in accordance with Supply System's proposals until such proposal has been resolved by the Project Consultant, whenever Supply System determines that the Administrator's proposals would create an immediate danger to the safe operation of the Project.

(f) The Administrator's approval or failure to disapprove any plan, proposal or item pursuant to the terms of this agreement shall not render the Government, its officers, agents, or employees, liable or responsible for any injury, loss, damage, or accident resulting from ownership, design, construction, operation, or maintenance of the Project.

(g) The word "item" as used in this section means the item described including the cost specified therefor.

11. *Replacements, Repairs and Capital Additions.*

(a) After the Date of Commercial Operation Supply System shall submit its plan, including but not limited to a financing plan, and budget of expenditures to the Administrator for each replacement, repair, or betterment relating thereto, or capital addition required by governmental agencies, each as related to the Project and having a cost, as estimated by Supply System, in excess of $3,000,000; *provided, however,* if the estimated cost of any such replacement, repair, or betterment relating thereto, or capital addition required by governmental agencies, exceeds 20 percent of the then depreciated value of the Project, the Administrator may direct that Supply System end the Project in accordance with Section 15. If the parties cannot agree upon such estimated costs, such estimated costs shall be referred to and determined by the Project Consultant. If the Administrator does not so direct within 90 days from the date such estimated cost has been so agreed upon or determined, Supply System shall proceed with its plan and budget of expenditures for such replacement, repair, or betterment relating thereto, or capital addition required by such governmental agency. Each such plan and budget or updated or revised budget relating thereto shall be submitted to the Administrator and shall become effective at the time and in the manner provided in section 6(a).

(b) Notwithstanding any other provisions of this agreement, Supply System shall not expend or obligate, without prior approval of the Administrator, moneys exceeding $50,000 in any Contract Year for capital additions to the Project unless such capital additions are required by governmental agencies.

(c) If in any Contract Year the amounts in the Annual Budget for renewals, repairs, and replacements and for capital additions and betterments necessary to achieve design capability or required by governmental agencies ("Amounts for Extraordinary Costs"), whether or not such amounts are costs of operation or costs of construction, exceed the amount of reserves, if any, maintained for such purpose pursuant to the Project Bond Resolution plus the proceeds of insurance, if any, available by reason of loss or damage to the Project, by the lesser of:

(1) an amount of $3,000,000 or

(2) an amount by which the amount of the Administrator's estimate of the total of the Administrator's net billing credits available in such Contract Year to the Participants pursuant to section 7(a) of the Net Billing Agreements and the amounts of such reserves and insurance proceeds, if any, exceeds the Annual Budget for such Contract Year exclusive of Amounts for Extraordinary Costs,

Supply System shall, in good faith, use its best efforts to issue and sell Project Bonds to pay such excess in accordance with section 5(a).

12. *Insurance.*

(a) Supply System shall maintain in force, for the benefit of the Project, the Administrator, Supply System, and the Participants as their respective interests shall appear, as a Project expense, such insurance as will satisfy the requirements of the Project Bond Resolution, the Atomic Energy Act of 1954 as amended, other insurance required by applicable statutes, and such other insurance as the parties agree. Subject to section 11 any proceeds of such insurance received by the Supply System for less or damage to the Project shall be used to repair the Project. Recognizing that at the time of the execution of this agreement the availability of insurance may be limited, if a second unit or generating project is proposed for the site of the Project, Supply System shall not, without the consent of the Administrator and the Participants' Review Board as established pursuant to section 17 of the Net Billing Agreements, cause the insurance on the Project to be extended to such unit or generating project nor lapse to permit the extension of such coverage.

(b) The Administrator may request additional insurance to the extent available, and Supply System shall purchase such requested insurance at the Administrator's expense. The proceeds from such requested insurance shall be disbursed as directed by the Administrator.

13. *Inspection of Project Facilities.* The Administrator may, but shall not be obligated to, inspect the Project at any reasonable time, but such inspection, or failure to inspect, shall not render the Government, its officers, agents, or employees, liable or responsible for any injury, loss, damage, or accident resulting from defect in the Project.

14. *Training.* Supply System shall carry out a familiarization and training program to maintain adequate staff for the Project and the expenses thereof shall be part of the direct or indirect costs of construction or costs of operation as appropriate.

15. *End of the Project.* The Project shall terminate and Supply System shall cause the Project to be salvaged, discontinued, decommissioned, and disposed of or sold in whole or in part to the highest bidder(s) or disposed of in such other manner as the parties may agree when

(a) Supply System determines it is unable to construct, operate, or proceed as owner of the Project due to licensing, financing, or operating conditions or other causes which are beyond its control.

(b) the parties determine the Project is not capable of producing energy consistent with Prudent Utility Practice or, if the parties disagree, the Project Consultant so determines, or

(c) the Administrator directs end of Project as provided in section 11(a).

The date of termination shall be the earliest of the date of the determination under subsections (a) or (b) above or the date of direction under subsection (c) above.

16. *Assignment of Agreement.* This agreement shall inure to the benefit of, and shall be binding upon, the respective successors and assigns of the parties to this agreement; *provided, however,* that neither this agreement, nor any interest therein shall be transferred or assigned by (a) Supply System to any entity other than the United States or an agency thereof, without written consent of the Administrator, or (b) the Administrator to any party other than the United States, or an agency thereof, without written consent of Supply System.

17. *Applicability of Other Instruments.* It is recognized by the parties hereto that Supply System in the ownership, construction and operation of the Project must comply with the requirements of the Project Bond Resolution and all licenses, permits and regulatory approvals necessary for such ownership, construction and operation, and it is, therefore, agreed that this agreement is made, and referrals to the Project Consultant hereunder shall be, subject to the terms and provisions of the Project Bond Resolution and all such licenses, permits, and regulatory approvals.

IN WITNESS WHEREOF, the parties hereto have executed this agreement in several counterparts.

UNITED STATES OF AMERICA
Department of the Interior

(SEAL)

By /s/ H. R. RICHMOND
Bonneville Power Administrator

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

(SEAL)

By /s/ OWEN W. HURD

ATTEST:

/s/ EDWIN W. TAYLOR

EXHIBIT A

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PROJECT NO. 2

Description of Project

The Washington Public Power Supply System's Nuclear Project No. 2 is expected to have a net electrical plant capability of approximately 1100 MW.

The site is located in the Federal reservation known as the Hanford Works of the U.S. Atomic Energy Commission. The site is near the Columbia River approximately 35 miles northwest of the City of Richland, Washington.

The plant and associated facilities will include a nuclear steam supply system, fuel and reactor coolant system with all related containment structures, safety features, instrumentation, control and auxiliary systems; turbine-generator, condensers and circulating water cooling systems, facilities and piping; electrical and mechanical systems and other related equipment and facilities; electrical facilities required to deliver the output of the project to the BPA transmission system at a point to be determined by the System and the Administrator; and other structures, shops, warehouses, construction facilities, offices, equipment or facilities required in the construction, maintenance and operation of the project.

A complete description of the project will be prepared after bids have been received and evaluated and awards have been made for major plant components.

EXHIBIT B

PROVISIONS REQUIRED BY STATUTE OR EXECUTIVE ORDER

act Work Hours and Safety Standards.

act, to the extent that it is of a character specified in the Contract Work Hours and Safety (Public Law 87-581, 76 Stat. 357-360, as amended) and is not covered by the Walsh-Contracts Act (41 U.S.C. 35-45), is subject to the following provisions and to all other exceptions of said Contract Work Hours and Safety Standards Act.

No Contractor or subcontractor contracting for any part of the contract work which may involve the employment of laborers or mechanics shall require or permit any laborer or in any workweek in which he is employed on such work, to work in excess of eight hours in dar days or in excess of forty hours in any workweek unless such laborer or mechanic receives tion at a rate not less than one and one-half times his basic rate of pay for all hours worked of eight hours in any calendar day or in excess of forty hours in such workweek, whichever eater number of overtime hours.

In the event of any violation of the provisions of subsection (a), the Contractor and any actor responsible for such violation shall be liable to any affected employee for his unpaid In addition, such Contractor or subcontractor shall be liable to the United States for liqui-mages. Such liquidated damages shall be computed, with respect to each individual laborer anic employed in violation of the provisions of subsection (a), in the sum of $10 for each day on which such employee was required or permitted to work in excess of eight hours cess of forty hours in a workweek without payment of the required overtime wages.

The Administrator may withhold, or cause to be withheld, from any moneys payable on of work performed by the Contractor or subcontractor, the full amount of wages required contract and such sums as may administratively be determined to be necessary to satisfy any ies of such Contractor or subcontractor for liquidated damages as provided in subsection (b).

(d) No contractor or subcontractor contracting for any part of the contract work shall require aborer or mechanic employed in the performance of the contract to work in surroundings or working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as mined under construction safety and health standards promulgated by the Secretary of Labor egulation based on proceedings pursuant to section 553 of title 5, United States Code, provided such proceedings include a hearing of the nature authorized by said section.

(e) The Contractor shall require the foregoing subsections (a), (b), (c), (d) and this sub-ion (e) to be inserted in all subcontracts.

(f) The Contractor shall keep and maintain for a period of three (3) years from the comple-of this contract the information required by 29 CFR §516.2(a). Such material shall be made lable for inspection by authorized representatives of the Government, upon their request, at onable times during the normal work day.

Convict Labor. The Contractor shall not employ any person undergoing sentence of imprison-d labor.

al Opportunity. Unless exempted pursuant to the provisions of Executive Order 11246 of 4, 1965 and the rules, regulations and relevant orders of the Secretary of Labor thereunder, rformance of this contract, the Contractor agrees as follows:

1) The Contractor will not discriminate against any employee or applicant for employment of race, color, religion, sex, or national origin. The Contractor will take affirmative action

to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Administrator setting forth the provisions of this equal opportunity clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Administrator, advising the labor union or worker's representative of the Contractor's commitments under this equal opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Administrator and the Secretary of Labor for purposes of investigations to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Contractor's noncompliance with the equal opportunity clause of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Administrator may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however,* that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Administrator, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

4. *Interest of Member of Congress.* No Member of or Delegate to Congress, or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise therefrom. Nothing, however, herein contained shall be construed to extend to such contract if made with a corporation for its general benefit.

EXHIBIT V

WOOD KING DAWSON LOVE & SABATINE
ATTORNEYS AND COUNSELLORS AT LAW

TELEPHONE 212 422-0450

DAVID M. WOOD (1892-1960)
GEORGE G. KING
JOHN B. DAWSON
LEROY LOVE
LEO E. SABATINE

BRENDAN O'BRIEN
EDWARD J. McCORMICK
SAMUEL I. HELLMAN

48 WALL STREET
NEW YORK, N.Y. 10005

Board of Directors
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
130 Vista Way
Kennewick, Washington

DEAR SIRS:

WASHINGTON PUBLIC POWER SUPPLY SYSTEM,
NUCLEAR PROJECT NO. 2 REVENUE NOTES,
$15,000,000

At your request we have examined into the validity of an issue of $15,000,000 Nuclear Project No. 2 Revenue Notes of Washington Public Power Supply System (the "System"), a municipal corporation of the State of Washington. Said notes are issuable in coupon form, are dated January 1, 1971, mature July 1, 1974, bear interest at the rate of three and five one-hundredths per centum per annum, payable semi-annually July 1 and January 1, notes numbered 1 to 149, inclusive, are of the denomination of $100,000 each, and notes numbered 150 to 153, inclusive, are of the denomination of $25,000 each. Said notes are subject to redemption prior to maturity upon the terms and conditions set forth therein, and recite that they are issued under and pursuant to Resolution No. 537, adopted by the Board of Directors of the System on the 4th day of December, 1970 (the "Note Resolution"), and under the authority of and in full compliance with the Constitution and statutes of the State of Washington, including Titles 43 and 54 of the Revised Code of Washington, and proceedings of the Board of Directors of the System duly adopted, for the purpose of paying a part of the cost of acquiring and constructing the Project (as such Project is defined in the Note Resolution).

We have examined the Constitution and statutes of the State of Washington, and certified copies of proceedings of the Board of Directors of the System authorizing the issuance of said notes, including the Note Resolution, and other proofs relating to the issuance of said notes, also an executed note of said issue.

In our opinion the Note Resolution has been duly adopted, the provisions thereof are valid and binding upon the System and said notes have been duly authorized and issued in accordance with the Constitution and statutes of the State of Washington, and constitute valid and legally binding obligations of the System, payable solely from any moneys of the System that may be lawfully applied to the payment thereof, including revenues of the Project, as the Project is defined in the Note Resolution, and the proceeds of revenue bonds or refunding notes of the System.

It is also our opinion that the interest on said notes is exempt from taxation by the United States of America under existing laws and regulations and a specific ruling issued by the Internal Revenue Service with respect to the notes, dated November 18, 1970.

Very truly yours,

WOOD KING DAWSON LOVE & SABATINE

WOOD KING DAWSON LOVE & SABATINE
ATTORNEYS AND COUNSELLORS AT LAW

TELEPHONE 212 422-0450

DAVID M. WOOD (1892-1960)
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48 WALL STREET
NEW YORK, N.Y. 10005

Board of Directors
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
130 Vista Way
Kennewick, Washington

DEAR SIRS:

**WASHINGTON PUBLIC POWER SUPPLY SYSTEM,
NUCLEAR PROJECT NO. 2 REVENUE NOTES,
$15,000,000**

Under date of , 1971, we rendered an opinion approving the validity of the above notes (the "Notes") issued pursuant to a resolution adopted by the Board of Directors of the Washington Public Power Supply System (the "System") on December 4, 1970 (the "Note Resolution").

We have examined into the validity of the Project Agreement (Contract No. 14-03-19121), dated January 4, 1971, between the United States of America, Department of the Interior, acting by and through the Bonneville Power Administrator, and Washington Public Power Supply System, referred to on page 13 of the Official Statement of the System, dated January 14, 1971, relating to the Notes. With respect to the authorization, execution and delivery of said agreement, we have examined certified copies of proceedings of the Board of Directors of the System authorizing the execution and delivery of said agreement, and such other documents, proceedings and matters relating to the authorization, execution and delivery of said agreement by each of the parties thereto as we deemed relevant. In our opinion, said agreement has been duly authorized, executed and delivered by each of the parties thereto and constitutes a valid and binding agreement enforceable in accordance with its terms.

We have also examined into the validity of of the Net Billing Agreements, referred to on page 11 of said Official Statement, among the United States of America, Department of the Interior, acting by and through the Bonneville Power Administrator, the System, and certain of the Participants referred to in Exhibit I of said Official Statement, which agreements provide for the purchase and assignment of an aggregate of % of the capability of the Project, as such Project is defined in the Note Resolution, and include all such Net Billing Agreements providing for the purchase and assignment by any Participant of more than per cent of the capability of the Project. With respect to the authorization, execution and delivery of said Net Billing Agreements, we have examined certified copies of proceedings of the System and of the Participants which are parties thereto, authorizing the execution and delivery of said Net Billing Agreements, and such other documents, proceedings and matters relating to the authorization, execution and delivery of said Net Billing Agreements by each of the parties thereto as we deemed relevant. In our opinion, each of said Net Billing Agreements has been duly authorized, executed and delivered by each of the parties thereto and constitutes a valid and binding agreement, enforceable in accordance with its terms.

In rendering this opinion, we have relied upon the opinion of counsel for each of the Participants that the Net Billing Agreement to which such Participant is a party has been duly executed and delivered by said Participant and is not in conflict with, or in violation of, and will not be a breach of, or constitute a default under, the terms and conditions of any other agreement or commitment by which such Participant is bound.

Very truly yours,

WOOD KING DAWSON LOVE & SABATINE

EXHIBIT VI

LAW OFFICES OF

HOUGHTON, CLUCK, COUGHLIN & RILEY

320 CENTRAL BUILDING

SEATTLE, WASHINGTON 98104

ROLLA V. HOUGHTON (1970)
JACK R. CLUCK
PAUL COUGHLIN
JOHN W. RILEY
EMIL P. SCHUBAT
DAVID SKELLENGER
BERTRAM L. METZGER, JR.

TELEPHONE
MAIN 3-6501

Board of Directors
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
130 Vista Way
Kennewick, Washington

DEAR SIRS:

WASHINGTON PUBLIC POWER SUPPLY SYSTEM,
NUCLEAR PROJECT NO. 2 REVENUE NOTES,
$15,000,000

At your request we have examined into the validity of an issue of $15,000,000 Nuclear Project No. 2 Revenue Notes of Washington Public Power Supply System (the "System"), a municipal corporation of the State of Washington. Said notes are issuable in coupon form, are dated January 1, 1971, mature July 1, 1974, bear interest at the rate of three and five one-hundredths per centum per annum, payable semi-annually July 1 and January 1, notes numbered 1 to 149, inclusive, are of the denomination of $100,000 each, and notes numbered 150 to 153, inclusive, are of the denomination of $25,000 each. Said notes are subject to redemption prior to maturity upon the terms and conditions set forth therein, and recite that they are issued under and pursuant to Resolution No. 537, adopted by the Board of Directors of the System on the 4th day of December, 1970 (the "Note Resolution"), and under the authority of and in full compliance with the Constitution and statutes of the State of Washington, including Titles 43 and 54 of the Revised Code of Washington, and proceedings of the Board of Directors of the System duly adopted, for the purpose of paying a part of the cost of acquiring and constructing the Project (as such Project is defined in the Note Resolution).

We have examined the Constitution and statutes of the State of Washington, and certified copies of proceedings of the Board of Directors of the System authorizing the issuance of said notes, including the Note Resolution, and other proofs relating to the issuance of said notes, also an executed note of said issue.

In our opinion the Note Resolution has been duly adopted, the provisions thereof are valid and binding upon the System and said notes have been duly authorized and issued in accordance with the Constitution and statutes of the State of Washington, and constitute valid and legally binding obligations of the System, payable solely from any moneys of the System that may be lawfully applied to the payment thereof, including revenues of the Project, as the Project is defined in the Note Resolution, and the proceeds of revenue bonds or refunding notes of the System.

It is also our opinion that the interest on said notes is exempt from taxation by the United States of America under existing laws and regulations and a specific ruling issued by the Internal Revenue Service with respect to the notes, dated November 18, 1970.

Very truly yours,

HOUGHTON, CLUCK, COUGHLIN & RILEY

LAW OFFICES OF
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320 CENTRAL BUILDING
SEATTLE, WASHINGTON 98104

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JOHN W. RILEY
EMIL P. SCHUBAT
DAVID SKELLENGER
BERTRAM L. METZGER, JR.

TELEPHONE
MAIN 3-6501

Board of Directors
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
130 Vista Way
Kennewick, Washington

DEAR SIRS:

**WASHINGTON PUBLIC POWER SUPPLY SYSTEM,
NUCLEAR PROJECT NO. 2 REVENUE NOTES,
$15,000,000**

Under date of , 1971, we rendered an opinion approving the validity of the above notes (the "Notes") issued pursuant to a resolution adopted by the Board of Directors of the Washington Public Power Supply System (the "System") on December 4, 1970 (the "Note Resolution").

We have examined into the validity of the Project Agreement (Contract No. 14-03-19121), dated January 4, 1971, between the United States of America, Department of the Interior, acting by and through the Bonneville Power Administrator, and Washington Public Power Supply System, referred to on page 13 of the Official Statement of the System, dated January 14, 1971, relating to the Notes. With respect to the authorization, execution and delivery of said agreement, we have examined certified copies of proceedings of the Board of Directors of the System authorizing the execution and delivery of said agreement, and such other documents, proceedings and matters relating to the authorization, execution and delivery of said agreement by each of the parties thereto as we deemed relevant. In our opinion, said agreement has been duly authorized, executed and delivered by each of the parties thereto and constitutes a valid and binding agreement enforceable in accordance with its terms.

We have also examined into the validity of of the Net Billing Agreements, referred to on page 11 of said Official Statement, among the United States of America, Department of the Interior, acting by and through the Bonneville Power Administrator, the System, and certain of the Participants referred to in Exhibit I of said Official Statement, which agreements provide for the purchase and assignment of an aggregate of % of the capability of the Project, as such Project is defined in the Note Resolution, and include all such Net Billing Agreements providing for the purchase and assignment by any Participant of more than per cent of the capability of the Project. With respect to the authorization, execution and delivery of said Net Billing Agreements, we have examined certified copies of proceedings of the System and of the Participants which are parties thereto, authorizing the execution and delivery of said Net Billing Agreements, and such other documents, proceedings and matters relating to the authorization, execution and delivery of said Net Billing Agreements by each of the parties thereto as we deemed relevant. In our opinion, each of said Net Billing Agreements has been duly authorized, executed and delivered by each of the parties thereto and constitutes a valid and binding agreement, enforceable in accordance with its terms.

In rendering this opinion, we have relied upon the opinion of counsel for each of the Participants that the Net Billing Agreement to which such Participant is a party has been duly executed and delivered by said Participant and is not in conflict with, or in violation of, and will not be a breach of, or constitute a default under, the terms and conditions of any other agreement or commitment by which such Participant is bound.

Very truly yours,

HOUGHTON, CLUCK, COUGHLIN & RILEY

EXHIBIT 5

EXHIBIT 5

INDENTURE OF LEASE

Executed by

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

and

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

TABLE OF CONTENTS

This Indenture of Lease, entered into this ___ day of _________________________, 1971, between the United States of America (hereinafter called the "Government"), represented herein by the United States Atomic Energy Commission (hereinafter called the "Commission"), and the Washington Public Power Supply System (hereinafter called the "Supply System"), a municipal corporation, joint operating agency and publicly owned utility organized under the laws of the State of Washington.

RECITALS

1. The Supply System is organized under Revised Code of Washington, Chapter 43.52, Laws of the State of Washington, and is authorized by law to lease or acquire land in order to construct and operate works, plants and facilities for the generation and/or transmission of electric power and energy.

2. The Board of Directors of the Supply System has by Resolution No. ___, dated ___________________, authorized the execution of this lease with the Commission for certain lands within the Federally owned area known as the Hanford Operations Area for the construction, operation, maintenance and use of a nuclear electric generating plant and related facilities.

3. The Commission, pursuant to the Atomic Energy Community Act of 1955, as amended, and 43 USCA 931, c., is authorized to lease to the Supply System land located within the Hanford Operations Area.

4. The Commission has determined that disposition through lease of such land will serve to prevent or reduce the adverse economic impact of actual or anticipated reductions in the Commission programs at the Hanford Project.

5. The Commission has taken all other requisite actions required by law in order to enter into this transaction.

INSTRUMENT OF LEASE

1. Definitions

As used in this contract:

(a) The term "Contracting Officer" means the person executing this Lease on behalf of the Government and includes his successors or any duly authorized representative of any such person.

(b) The term "Commission" means the United States Atomic Energy Commission or any duly authorized representative or successor thereof, including the Contracting Officer except for the purpose of deciding an appeal under the article entitled "Disputes".

(c) "Revenue Bonds" mean the bonds issued by the Supply System as authorized by its Bond Resolution.

(d) "Supply System" means the Washington Public Power Supply System, a joint operating agency of the State of Washington, and its officers and employees while acting within the scope of their authority.

2. Purpose and Scope of Lease

(a) The Supply System covenants with the Commission that the leased premises shall be occupied and used solely for the construction, operation, maintenance and use of the nuclear electric generating plant and related facilities, and for such other uses as may be authorized in writing from time to time by the Commission under terms and conditions to be agreed upon by the parties.

(b) The Supply System covenants that it will, at its own expense, design, construct, operate, maintain and use the plant and related facilities in accordance with applicable laws and regulations, including but not limited to the construction permit and operating license granted by the Commission, and consistent with safe and reliable utility practices.

(c) The Supply System covenants that it will, at its own expense, design, construct, operate, maintain and use the plant and related facilities in a manner determined by the Commission that will not materially interfere with the Commission's then existing operations and programs in the Hanford Operations Area; or with operations or programs proposed to be conducted in such area provided that such proposed operations or programs are being actively considered by the Manager of the Richland Operations Office or his designee or higher Commission authority. Such determinations regarding material interference shall be made promptly upon request of the Supply System. The Commission will promptly advise the Supply System of its determination regarding material interference with respect to any significant changes or alterations subsequently proposed by the Supply System. In the event that the Commission determines that the design, construction, maintenance or operation of the plant and related facilities, or any significant changes or alterations thereof will materially interfere with such operations and programs, it will provide its reasons therefor, including appropriate supporting data. The Supply System shall submit to the Commission at its offices in Richland, Washington, such information and documentation as is necessary to enable the Commission to make such determinations. In the event that the Contracting Officer determines that the Supply System is not maintaining or operating the plant and related facilities in compliance with the manner that the Commission has previously determined will not materially interfere with the Commission's operations and programs, the Contracting Officer may require the Supply System to take such corrective action at its own expense as may be required to achieve compliance.

(d) The action of the Commission in entering into this Lease is not to be construed as any guarantee or assurance that a construction permit or operating license will be issued for the nuclear electric operating plant. The terms and conditions of any such permit or license are in addition to the requirements of this Lease; provided, however, that the Commission's actions under this Lease shall not be contrary to any requirement which is a condition of the permit or license.

3. <u>Conveyance of Interest in Land</u>

The Government, as lessor, for and in consideration of the rents, covenants, conditions, warranties, and agreements herein contained as assumed by the Supply System, lessee, does hereby demise and lease to the Supply System real property of the Government situated in the County of Benton, State of Washington (hereinafter called the "Leased Premises"), and within the Federally owned area known as the Hanford Operations Area, United States Atomic Energy Commission, all as more particularly described below.

A parcel of land lying in Sections 2, 3, 4, and 5 of Township 11 North, Range 28 East, WM, described as follows:

(a) Beginnning at the Southwest corner of section 11, Township 11 North, range 28 East, W.M., said corner having Washington State coordinates, South zone, of North 408,335.30 and East 2,307,653.50; thence North 0°41'08" East 8,065.28 feet to the TRUE POINT OF BEGINNING; thence West 11,153.57 feet; thence South 01°01'23" East, 3000.48 feet; thence South 88°53'54" West 5,200.96 feet; thence North 0°31'41" West 3690.15 feet; thence East 1,430.00 feet; thence North 1,865.69 feet; thence North 87°46'08" East 3,703.83 feet; thence South 01°01'23" East 1,600.25 feet; thence East 11,189.29 feet; thence North 01°01'23" East 1,800.29 feet; thence North 89°07'55" East, 3,300.38 feet to the line of Navigation of the West bank of the Columbia River; thence southerly along said line of Navigation to a point that bears North 89°15'21" East from the TRUE POINT OF BEGINNING; thence South 89°15'21" West 3,850.32 feet more or less to the TRUE POINT OF BEGINNING.

(b) That portion of the above described property located within Section 5, Township 11 North Range 28 East, WM, Benton County, Washington, is designated "Parcel A". The balance of the above described property is designated as "Parcel B".

(c) The Supply System shall not build any permanent structures on the leased premises within 200 feet of the North-South boundary line between Coordinates N13559.97 and W2444.21, and N11694.29 and W2449.00, without the prior written approval of the Commission. The Commission reserves the right to drill test holes and to install monitoring equipment and to excavate and remove the earth within this area.

(d) The Commission also reserves the right to operate, maintain, repair and replace any of its existing railway facilities and any of its existing underground or overhead utility lines on the leased premises.

4. <u>Ingress and Egress Rights to Leased Premises</u>

(a) Together with and as a part of this Lease, the Commission grants a general right of ingress and egress to and from the Leased Premises, over and above the Government owned roads and streets located within the Hanford Operations Area. In addition, the Commission grants a general right of ingress and egress over and above the Government owned railways for as long as the railways are maintained and operated by the Commission or its contractors. The Supply System's right to the use of said roads, streets and railways shall not be exclusive but shall be of equal standing with that of the Commission's employees and other authorized personnel using said roads, streets and railways, and shall be subject to such reasonable rules and regulations of general application to the reservation as may be promulgated by the Commission. In the event that the Commission discontinues operation and maintenance of the Government owned railways, the Government will exert its best efforts to permit the Supply System to continue to use the system.

(b) To the extent that it does not interfere with the use of the Leased Premises for the purpose and scope of this Lease, as provided in Article 2 hereof, the Commission may, but shall not be obligated to, relocate, close, vacate, alter, widen, extend, grade, improve, repair, maintain and regulate the use of the said roads, streets and railways, and may, at any time or times provide alternate ingress or egress ways to the Leased Premises over specific roads, streets or railways of the Commission within the Hanford Operations Area.

(c) To the extent deemed necessary for the protection of health and safety and/or the protection of property, the Commission may, but shall not be obligated to, deny access to the Leased Premises, provided, however, that the Commission shall give such advance notice as circumstances permit. The Commission's determination that the action(s) described in the preceding sentence is necessary shall be conclusive and the Government, the Commission, their officers, employees, or authorized representatives shall not be liable for any loss or damage resulting from the Supply System having been denied access to such Leased Premises.

5. Construction of Roads and Tracks - Rights of Way

(a) The Supply System may construct and maintain railway tracks and roads on the Leased Premises as it may require for the construction and operation of the plant and related facilities. The construction and maintenance of such tracks and roads shall meet as a minimum the then current Hanford Standards. Connections to Commission railroads shall be a location mutually agreed upon by the parties. The Commission shall have the right of ingress and egress to and from the Leased Premises over any roads and tracks constructed by the Supply System.

(b) Subject to the provisions of Section 161, q., of the Atomic Energy Act of 1954, as amended, the Commission has authority to grant easements for rights of way for roads, transmission lines and for any other purpose and agrees to negotiate with the Supply System for such rights of way over the Hanford Operations Area as are necessary to service the Leased Premises.

6. Additional Reserved Rights of the Commission

The Commission reserves from the Leased Premises the following rights in addition to the rights otherwise provided for in this Lease:

The right to construct on the Leased Premises and to maintain, repair and replace utility lines as may be necessary to provide electricity, heat, water, steam, power, gas, telephone and other communication services, to the extent necessary for Commission purposes; provided, that such lines will not unreasonably interfere with any of the Supply System's operations; and

The right to construct on the Leased Premises and to maintain, repair and replace drainage facilities including sanitary sewers, storm sewers, and other piping and conduits to the extent necessary for Commission purposes; and

The right to place on the Leased Premises, to use, repair and maintain monitoring facilities, and fire control and alarm facilities, to the extent necessary for Commission purposes; and

The right to construct on the Leased Premises and to maintain, repair and replace access roads and railroad facilities to the extent necessary for Commission purposes; provided, that such roads and railroad facilities will not unreasonably interfere with any of the Supply System's operations.

7. <u>Exclusion Area</u>

The Commission recognizes the exclusion area as provided for in the operating license and will undertake no action or activity which would interfere with or restrict the Supply System's right to fully comply with this condition of the operating license.

8. <u>Term of the Lease</u>

The term of this lease shall commence at 12:01 a.m. on ____________ and continue for a term of 50 years as to Parcel A and for a term of 30 years as to Parcel B. As to Parcel A, the Commission grants to the Supply System an option to extend the lease for an additional period of ten years, provided that the Supply System gives the Commission written notice of its intention to exercise this option not less than one year prior to the expiration date as to Parcel A. The Commission further grants to the Supply System an additional option, thereafter, to further extend the term of this lease as to Parcel A for an additional ten-year period provided that written notice of the exercise of this second ten-year option to extend the term of the lease is given to the Commission not less than one year prior to the expiration of such ten-year option. The Commission agrees to negotiate in good faith for an extension of the terms of Parcel B for a reasonable term upon notification by the Supply System one year prior to the expiration date of Parcel B.

9. Payments

(a) The Supply System shall pay to the Commission as rent for the Leased Premises and for the rights and privileges obtained under this instrument the sum of $3,976.00 annually for the first five annual periods hereof and, subject to the provisions of subparagraph (b) of this article, the sum of $7,952.00 for each succeeding annual period during the remaining term hereof. The first annual payment shall be due and payable upon execution of this Lease; succeeding annual payments shall be payable annually in advance on or before each anniversary date hereof.

(b) After the tenth anniversary date of this Lease and at subsequent intervals of five or more years, the Commission may require an appraisal of the Leased Premises for the purpose of enabling the Commission to determine the fairness of the annual rent. Such appraisal(s) shall be by an appraiser selected by the Commission, an appraiser selected by the Supply System, and a third appraiser selected by the two persons thus designated. On the basis of those appraisals and after consultation with the Supply System and consideration of any relevant information provided by the Supply System, the Commission may, by written notice to the Supply System, revise the aforesaid annual rent to such amounts as are determined by the Commission to be the fair rental value for the Leased Premises. Those revised amounts shall, during the remaining term of this Lease, continue in effect and be paid by the Supply System unless and until they are revised as a result of subsequent appraisals and determination by the Commission in the manner described in this subparagraph.

(c) The Supply System will pay for supplies and services provided pursuant to Article 16 herein, in accordance with charges to be established by the Commission. Such charges will be based upon the Commission's established pricing policy. A statement of such pricing policy will be furnished the Supply System upon request. The Commission's pricing policy may be amended from time to time.

(d) All payments hereunder shall be made in lawful money of the United States at the offices of the Commission in Richland, Washington, or elsewhere if so designated by the Commission, without notice or demand therefor from the Commission. With respect to payments under subparagraph (c) hereto, the Supply System shall advance an amount equal to the Commission's estimate of such cost. Upon ascertainment of the exact cost any necessary adjustments will be promptly made.

10. Condition of Leased Premises

The Supply System has inspected and is fully familiar with the physical condition of the Leased Premises. The Commission has made no representations, warranties, or undertakings as to such condition, or that the Leased Premises are free and clear of all contamination and hidden hazards or as to the fitness or availability of the Leased Premises for any particular use.

11. Termination

(a) This Lease is made subject to the condition that if there should occur any of the events hereinafter provided in this paragraph, the Commission may terminate this Lease under the conditions and in the manner hereafter stated and sue for and recover all rents and damages accruing hereunder, or may sue and recover without terminating the Lease; provided, that upon any such termination the Commission may re-enter and take possession of the Leased Premises without compensation to the Supply System on account of such termination.

(1) In the event the Supply System uses the Leased Premises in a manner not in substantial compliance with the covenants and purposes provided herein or discontinues its use of the Leased Premises for such purposes, and such misuse or disuse continues for sixty (60) days after written notice thereof has been given by the Commission to the Supply System, the Commission may, upon the expiration of said sixty (60) days or at any time thereafter, by giving

the Supply System written notice, terminate this Lease, and this Lease shall expire upon the date specified in such notice.

(2) In the event the Supply System shall become insolvent, make an assignment for the benefit of creditors, file a petition in bankruptcy, seek the benefit of any bankruptcy, composition or insolvency law, or be adjudged bankrupt, or if a receiver or trustee of the property of the Supply System shall be appointed, the Commission may immediately or at any time thereafter, by written notice to the Supply System, terminate this Lease and this Lease shall expire upon the date specified in such notice; provided that, if such default be cured by the Supply System prior to the termination date specified in such notice, this Lease shall remain in full force and effect if the provisions of the preceding subparagraph (1) do not apply.

(b) In the event the Supply System is unable, for any reason, to obtain the necessary permits and licenses required by Article 19 hereof, including but not limited to a construction permit, the Supply System shall immediately provide written notice thereof to the Commission and this Lease shall terminate upon the date specified in such notice. Subject to the provisions of Article 12 the Supply System's liability in the event of termination pursuant to this paragraph shall be limited to the amounts due under Article 9, prorated as of the date of termination.

12. <u>Ownership, Removal and Disposition of Property</u>

(a) All alterations, additions and improvements to the Leased

Premises made by the Supply System, including the plant, shall be and remain the property of the Supply System during the term of this Lease, irrespective of the manner in which they may be attached to the land. If, prior to the execution or termination of this Lease, the Commission and the Supply System agree upon and execute an extension or renewal of this Lease or any new lease covering the same premises, all such alterations, additions and improvements shall remain the property of the Supply System during the term thereof.

(b) The Supply System shall have a period of one year following expiration or termination of this Lease to remove, dismantle and salvage any of its property whether affixed to the land or not, provided that with respect to the removal, dismantling and salvaging of property affixed to the land if requested by the Commission, the premises shall be returned as nearly as possible to its original condition at the time of execution of this lease. Any property of the Supply System whether affixed to the land or not, not so removed, shall thereupon become and be the property of the Government, free of all encumbrances, without cost to the Government.

(c) Upon expiration or termination of this Lease, the Supply System shall, at its own expense, secure the Leased Premises and all facilities and property located thereon against all health and safety hazards to the satisfaction of the Commission, provided, however, the Commission's requirements hereunder shall not be contrary to any requirement imposed by applicable laws or regulations, or any license or permit.

(d) In the event that this Lease is terminated by the Supply System under Article 11 (b), the Supply System shall, if requested by the Commission, remove any alterations, improvements or additions to the Leased Premises and restore the premises to the original condition as near as may be possible subject to the approval of the Commission.

13. Protection Against Claims and Losses

(a) The Government, the Commission, contractors of the Commission, and the officers, employees or representatives of any of them shall not be liable for and the Supply System shall indemnify and save them and each of them free and harmless from any and all liability, loss, damage, or costs (including attorney's fees) incurred in the defense of or arising out of any claim, suit, action or other legal proceedings brought against any of them by third parties for injury to or death of persons or injury to or destruction of property caused by or arising out of: (1) the conduct of the business of the Supply System or its use of the Leased Premises, or any operations which are necessary or incidental thereto, (2) the erection or removal of any equipment, building or part thereof, or the making of any repairs, replacements, alterations, additions and/or improvements to the Leased Premises, or (3) any default or negligence in the performance of any covenant or obligation of the Supply System hereunder; provided, that the foregoing shall not apply to any injury, destruction or death (1) as may be caused by the negligence or default of the Government, the Commission, contractors of the Commission, and the officers, employees or representatives of any of them, or (2) as to which the Supply System is a person indemnified by the Commission under Section 170 of the Atomic Energy Act of 1954, as amended.

(b) Unless otherwise requested by the Commission in writing, the Supply System shall maintain, or cause to be maintained, insurance in at least such minimum amounts as required by the Commission from time to time in writing for purposes of providing protection against the claims, suits, actions and other legal proceedings specified in the preceding paragraph (a) of this article. Copies of such insurance policy or policies shall be filed with and shall be subject to the approval of the Commission, and the Commission shall be given ten (10) days advance notice by mail of any changes in or cancellation of any such insurance.

14. <u>Access to Leased Premises by Commission</u>

In addition to any rights the Commission may have under any licensing arrangement required by law, the Commission, or any person authorized by it, shall at all times have access to the Leased Premises for all reasonable purposes.

15. <u>Rights and Remedies; No Waiver Implied</u>

All rights and remedies of the Commission or the Supply System under this Lease shall be cumulative and none shall exclude any other allowed either party by law, and the use of or resort to any one or more shall not exclude or be deemed a waiver of any other or others; nor shall any express or implied waiver of a breach of any term, covenant or condition of this Lease constitute or be construed as a waiver of any other breach of the same or any other term, covenant or condition.

16. Government-Furnished Supplies and Services

The Commission shall, if requested by the Supply System and after reasonable notice, provide the Supply System with supplies and services to the extent (1) that they are not reasonably commercially available, (2) that the Commission determines it has such supplies and services available in the Hanford Operations Area in excess of its own requirements in that area, and (3) that the Commission continues to provide such supplies and services for its own activities in the vicinity of the Supply System's facilities within the Hanford Operation Area.

Notwithstanding the provisions of the above paragraph of this article, the Government, the Commission, contractors of the Commission, and the officers, employees or representatives of any of them shall not be liable for any losses, damages or costs arising out of temporary interruptions in such services or for any failure to provide such services.

17. Covenants and Conditions

All of the terms and provisions of this Lease to be performed or complied with by the Lessee shall be deemed and construed to be "covenants" or "conditions" as though words specifically expressing or importing covenants and conditions were used in each separate term and provision hereof, and the same shall be construed as covenants running with the land.

18. Prohibition Against Assignment

(a) The Supply System, its successors and assigns shall have no right, authority, or power without the written consent of the Commission: (1) to transfer this Lease, any interest herein, or any right hereunder, by way of assignment, sublease, or other arrangement to any other person to occupy space in or make any continuing use of any part of the Leased Premises, or (2) permit any act, by way of pledge, hypothecation or sufferance of lien, voluntarily or by operation of law, which would in any way encumber any title or interest of the Government in and to said Leased Premises or any part thereof.

(b) In the event the Supply System sublets, assigns, or takes or permits any action referred to in paragraph (a) above, with respect to any part of the Leased Premises whether with or without the Commission's written consent, the Supply System shall remain responsible to the Commission for such part of the Leased Premises, the use thereof, and all other obligations hereunder, as if such subletting or action had not been taken or permitted, unless specifically relieved of such responsibility in writing by the Commission.

19. Permits and Licenses

The Supply System shall procure all necessary permits and licenses and abide by all applicable laws and regulations and ordinances of the United States and of the State, territory, and political subdivision in which the Leased Premises are located.

20. Taxes and Assessments; Payments in Lieu Thereof

The Supply System shall have the duty to pay and shall save and hold harmless the Commission from the payment of all legally imposed taxes, assessments for local improvements and similar charges which may be levied by any duly constituted authority of the State, County, or other political subdivision of the State upon the leasehold estate herein created, the Leased Premises and all buildings or other improvements now or hereafter upon the Leased Premises. In the event that, under any statute now or hereafter enacted, the Commission shall make payments in lieu of taxes or assessments to any such authority on account of such property, the Supply System shall pay to the Commission the amount of such payments and such amount shall become due and payable as additional rent hereunder.

21. Disputes

(a) Except as otherwise provided in this Lease, any dispute concerning a question of fact arising under this Lease which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Supply System. The decision of the Contracting Officer shall be final and conclusive unless within 30 days from the date of receipt of such copy, the Supply System mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the Commission. The decision of the Commission or its duly authorized representative for the determination of such appeals shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence. In connection with any appeal proceeding under this article, the Supply System shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Contracting Officer's decision shall be controlling.

(b) This "Disputes" article does not preclude consideration of law questions in connection with decisions provided for in paragraph (a) above; provided, that nothing in this contract shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

22. Equal Opportunity

Unless exempted pursuant to Executive Order 11246 of September 24, 1965, and the rules, regulations and relevant orders of the Secretary of Labor thereunder, the Supply System agrees as follows:

(a) The Supply System will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Supply System will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Supply System agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this Equal Opportunity article.

(b) The Supply System will, in all solicitations or advertisements for employees placed by or on behalf of it, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Supply System will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Contracting Officer, advising the said labor union or workers' representative of the State's commitments under this Equal Opportunity article, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Supply System will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Supply System will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Commission and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Supply System's noncompliance with the Equal Opportunity article of this Lease or with any of the said rules, regulations, or orders, this Lease may be canceled in whole or in part and the Supply System may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rules, regulations, or orders of the Secretary of Labor or as otherwise provided by law.

(g) The Supply System will include the provisions of paragraphs (a) through (g) in every sublease, subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each sublessee, subcontractor or vendor. The Supply System will take such action with respect to any sublease, subcontract or purchase order as the Commission may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the Supply System becomes involved in, or is threatened with, litigation with a sublessee, subcontractor or vendor as a result of such direction by the Commission, the Supply System may request the United States to enter into such litigation to protect the interests of the United States.

23. Officials Not to Benefit

No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Lease, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this Lease if made with a corporation for its general benefit.

24. Covenant Against Contingent Fees

The Supply System warrants that no person or selling agency has been employed or retained to solicit or secure this Lease upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Supply System for the purpose of securing business.

25. Convict Labor

In connection with the performance of work under this Lease, the Supply System agrees not to employ any person undergoing sentence of imprisonment at hard labor.

26. Third Parties

Nothing in this Lease shall be construed to grant, vest, or allow any right to be given to any employee or other third party, or to the legal representatives, heirs, assigns, or successors of any of them, as a third party beneficiary. This provision is not intended to limit or impair the rights which any person may otherwise have under applicable Federal statutes or which are granted or reserved to the Government in this Lease.

27. Headings

The headings in this Lease are for purposes of reference and convenience only and shall not limit or otherwise define the meaning hereof.

IN WITNESS WHEREOF, the parties hereto have executed this Lease as of the ___ day of __________, 19__.

UNITED STATES OF AMERICA
UNITED STATES ATOMIC ENERGY COMMISSION

By ____________________________

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

By ____________________________

WITNESSES:

____

____
(Address)

____

____
(Address)

(FOR LESSEE)

STATE OF WASHINGTON)
) ss
COUNTY OF BENTON)

On this ____ day of ______________________, 19___, before me personally appeared ____________________________, to me known to be ___________________________ of Washington Public Power Supply System, a municipal corporation of the State of Washington, that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said municipal corporation, for the uses and purposes therein mentioned, and on oath stated that he was authorized to execute said instrument and that the seal affixed is the corporate seal of said municipal corporation.

In Witness Whereof, I have hereunto set my hand and affixed my official seal the day and year first above written.

____
Notary Public in and for the State of Washington, residing at
__________________________.

(Seal)

(FOR LESSOR)

STATE OF WASHINGTON)
) ss
COUNTY OF BENTON)

On this ____ day of ______________________, 19___, before me personally appeared ______________________________, to me known to be an authorized representative of the United States Atomic Energy Commission, an instrumentality of the United States, that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said Commission, for the uses and purposes therein mentioned, and on oath stated that he was authorized to execute said instrument.

In Witness Whereof, I have hereunto set my hand and affixed my official seal the day and year first above written.

____
Notary Public in and for the State of Washington, residing at
_________________________.

(Seal)