

Executive Summary

Introduction ES-1
Overview of the Recommended Plan ES-2
Coordinated Planning Approach ES-3
Elements of the Recommended Plan ES-6
Conveyance ES-8
Treatment ES-10
Water Conservation ES-13
Management of Reclaimed Water ES-14
Biosolids Management ES-14
Implementation ES-14

1—Introduction

1.1 Background 1-1
 1.1.1 2007 Wastewater Facilities Plan Amendment 1-1
 1.1.2 2002 Wastewater Facilities Plan 1-2
 1.1.3 2003 Facilities Plan Amendment 1-2
 1.1.4 Ecology Approval of Wastewater Facilities Plan 1-3
 1.1.5 Changes since 2003 Wastewater Facilities Plan Amendment 1-4
 1.1.6 Environmental Analysis 1-4
1.2 Authorization 1-4

2—Basis of Planning Summary

2.1 Basis of Planning Report 2-1
2.2 Goals and Objectives of the Basis of Planning 2-1
2.3 Planning Area Characteristics 2-2
 2.3.1 Planning Area Definition 2-2
 2.3.2 Physical Environment 2-2
 2.3.3 Water Resources 2-4
 2.3.4 Human Environment 2-4
2.4 Planning Projections 2-6
 2.4.1 Population and Land Use Forecasts 2-6
 2.4.2 2006 Wastewater Flow Analysis 2-7
 2.4.3 Wastewater Flow Projections 2-11
 2.4.4 Conveyance and Treatment Hydraulic Capacity Sizing Strategy 2-13
 2.4.5 Wastewater Loading Projections 2-14
2.5 Water Quality and Water Resource Issues 2-18
 2.5.1 Spokane Valley-Rathdrum Prairie Aquifer System 2-18
 2.5.2 Surface Waters 2-19
 2.5.3 Dissolved Oxygen Total Maximum Daily Load (TMDL) 2-19
 2.5.4 Foundational Concepts for the Spokane River TMDL Managed
 Implementation Plan 2-20
 2.5.5 Potential Spokane River Effluent Discharge Requirements 2-22
2.6 Other Spokane River Water Quality Issues 2-25
 2.6.1 Polychlorinated Biphenyls (PCBs) 2-25

2.7	Effluent Reuse.....	2-27
2.8	Biosolids Management.....	2-27
2.9	Existing Wastewater Facilities and Programs.....	2-28
2.10	Stakeholder Values and Concerns	2-28

3—Alternatives Evaluation

3.1	Introduction.....	3-1
3.2	Facilities Planning Alternatives Evaluation Process.....	3-1
3.2.1	Development of Representative Treatment Systems	3-1
3.2.2	Development of Conveyance Requirements.....	3-1
3.2.3	Treatment and Conveyance System Alternatives	3-2
3.3	Treatment Technologies Evaluation	3-3
3.3.1	Selected Treatment Technology	3-3
3.4	Water Reclamation Facility Siting Alternatives	3-4
3.4.1	Selected Water Reclamation Facility Site.....	3-4
3.5	Conveyance System Alternatives	3-5
3.5.1	North Valley Interceptor (NVI) Pumping Station	3-5
3.5.2	North Valley interceptor (NVI) Forcemain	3-5
3.5.3	Spokane valley interceptor (SVI) Pumping Station.....	3-6
3.5.4	Spokane Valley interceptor (SVI) Forcemain Routes	3-6
3.6	Effluent Outfall to the Spokane River	3-6
3.6.1	Recommended Effluent Outfall Location.....	3-6
3.7	Solids Processing and Biosolids Management	3-7
3.7.1	Discussion of Biosolids Alternatives Relative to Evaluation Criteria	3-7
3.7.2	Recommended Biosolids Management.....	3-8
3.8	Wastewater Management Options Currently Available to Spokane County.....	3-9
3.9	Development of Costs.....	3-9

4—Water Conservation Alternatives

4.1	Introduction.....	4-1
4.1.1	Loan Reduction versus Load Diversion Programs	4-1
4.1.2	Organization of the Chapter.....	4-2
4.2	LOTT Experience	4-2
4.2.1	Water Conservation	4-3
4.2.2	Infiltration and Inflow Control.....	4-3
4.2.3	Wasteload Diversion	4-4
4.2.4	LEED Building Certification and Water Consumption Reduction.....	4-4
4.2.5	Summary of the LOTT Experience.....	4-5
4.3	Water Conservation Alternatives.....	4-5
4.3.1	Water Conservation – Public Education	4-6
4.3.2	Water Conservation – Economic Incentives.....	4-7
4.3.3	Water Conservation – Metering.....	4-8
4.3.4	Water Conservation – Physical Devices.....	4-8
4.3.5	Impact of Water Conservation on Wastewater Management	4-13
4.4	Infiltration and Inflow Control.....	4-13
4.4.1	Sewer Rehabilitation.....	4-13

4.4.2 Disconnect Sumps.....4-14

4.4.3 Review Codes, Inspection and Enforcement4-15

4.5 Industrial and Commercial Load Reduction.....4-15

4.5.1 Pretreatment Requirements.....4-16

4.5.2 High Strength Surcharges4-17

4.5.3 Water Recycling and Waste Minimization.....4-18

4.6 Leadership in Environmental and Energy Design (LEED)4-19

4.6.1 Water Conservation and LEED4-22

4.6.2 Example LEED Commercial Buildings.....4-24

4.6.3 Phosphorus Load Reduction Potential from LEED4-26

5—Effluent End Use Alternatives

5.1 Introduction.....5-1

5.1.1 Discharge to Surface Waters.....5-1

5.1.2 Irrigation of Agricultural Land5-2

5.1.3 Irrigation of Poplar Farms.....5-2

5.1.4 Irrigation of Urban Green Spaces5-2

5.1.5 Industrial Reuse5-2

5.1.6 Wetlands Creation or Enhancement.....5-2

5.1.7 Groundwater Recharge5-3

5.1.8 Public Education.....5-3

6—Treatment Systems

6.1 Introduction.....6-1

6.2 Advanced Wastewater Treatment Process Performance6-1

6.2.1 Advanced Wastewater Treatment Process Workshop6-2

6.2.2 Capabilities of Treatment Technology and Discharge Permitting.....6-3

6.3 Advanced Wastewater Treatment Process Evaluation6-3

6.3.1 Originally Proposed Process Design.....6-4

6.3.2 Advanced Process Alternative Analysis for Low Phosphorus6-5

6.3.3 Impact of Key Process Parameters6-6

6.3.4 AWT Alternative 1 – Membrane Bioreactor (MBR) with Nitrogen
Removal and Chemical Phosphorus Removal.....6-8

6.3.5 AWT Alternative 2 – Membrane Bioreactor (MBR) with Biological
Nutrient Removal (BNR) and Chemical Polishing.....6-9

6.3.6 Alternative AWT Alternative 3 – Membrane Bioreactor (MBR) with
Biological Nutrient Removal (BNR) and Tertiary Chemical Polishing6-11

6.3.7 AWT Alternative 4 – Conventional Activated Sludge with Tertiary
Membrane Filtration6-12

6.3.8 Advanced Treatment Process Alternative Mass Balance Analysis6-13

6.3.9 Proposed Treatment Process.....6-15

6.3.10 Projected Effluent Performance.....6-15

6.4 Projected Effluent Performance.....6-17

6.4.1 Design Flows and Loads.....6-18

6.4.2 Process Schematics.....6-18

6.4.3 Mass Balance6-18

6.4.4	Unit Process Design Criteria.....	6-18
6.4.5	Hydraulic Profile.....	6-18
6.5	Preliminary Site Layout.....	6-29
6.6	Summary Description of Unit Processes	6-29
6.6.1	Influent Flow Measurement and Influent Junction Box	6-29
6.6.2	Septage Handling.....	6-29
6.6.3	Preliminary Treatment	6-30
6.6.4	Primary Treatment	6-30
6.6.5	Fine Screening	6-30
6.6.6	Membrane Bioreactors.....	6-30
6.6.7	Effluent Flow Measurement	6-30
6.6.8	Disinfection and Dechlorination.....	6-31
6.6.9	Postaeration.....	6-31
6.6.10	Reclaimed Water Pumping.....	6-31
6.6.11	Chemical Feed Systems	6-31
6.6.12	Primary Sludge Thickening and Fermentation	6-31
6.6.13	Waste Activated Sludge Thickening.....	6-31
6.6.14	Anaerobic Digestion	6-32
6.6.15	Liquid Biosolids Storage.....	6-32
6.6.16	Digester Gas Management.....	6-32
6.6.17	Solids Dewatering.....	6-32
6.6.18	Dewatered Biosolids Storage.....	6-32
6.6.19	Centrate Storage.....	6-32
6.7	Aesthetic Concept and Impact Mitigation Measures.....	6-33
6.7.1	Architecture.....	6-33
6.7.2	Landscaping.....	6-33
6.7.3	Odor Control.....	6-33
6.7.4	Noise Control.....	6-34
6.7.5	Lighting Control.....	6-34
6.7.6	Security	6-34
6.8	Other Treatment Plant Features	6-35
6.8.1	Electrical Power Supply.....	6-35
6.8.2	Other Utilities.....	6-35
6.8.3	Instrumentation and Control	6-35
6.8.4	Stormwater Management.....	6-35

7—Biosolids Management

7.1	Introduction.....	7-1
7.2	Projected Sludge Quantity and Characteristics.....	7-1
7.3	Summary of Regulations.....	7-3
7.4	Advances in Solids Processing Equipment and Technology.....	7-3
7.5	Recommended Biosolids Alternative	7-4
7.5.1	Alternative B-1: Class B Biosolids and Land Application.....	7-4
7.5.1.1	Applicability to Spokane County.....	7-4

8—Public Values

8.1	Introduction.....	8-1
8.2	2002 Wastewater Facilities Plan (December 2002).....	8-1
8.3	2003 Wastewater Facilities Plan Amendment (February 2003).....	8-1
8.4	2004 Public Information Process.....	8-2
8.5	2007 Wastewater Facilities Plan Amendment.....	8-2
8.5.1	Advanced Wastewater Treatment Process Workshop.....	8-2
8.5.2	November 1, 2006 Stockyards Site Conditional User Permit Public Meeting.....	8-3
8.5.3	November 15, 2006 Public Meeting.....	8-3
8.5.4	November 30, 2006 Planning Commission Briefing.....	8-3

9—Recommended Plan

9.1	Introduction.....	9-1
9.2	Water Conservation.....	9-1
9.3	Conveyance and Treatment.....	9-3
9.3.1	Overview.....	9-3
9.3.2	Conveyance.....	9-5
9.4	Treatment.....	9-7
9.4.1	City of Spokane Riverside Park Water Reclamation Facility (RPWRF).....	9-7
9.4.2	New Spokane County Regional Water Reclamation Facility.....	9-7
9.4.3	Effluent Outfall to the Spokane River.....	9-10
9.5	Management of Reclaimed Water.....	9-10
9.6	Biosolids Management.....	9-11
9.7	Cost Estimate.....	9-11
9.7.1	Capital.....	9-11
9.7.2	Estimated Operating and Maintenance Costs.....	9-15
9.8	Expected Performance and Water Quality Issues.....	9-17

10—Implementation Plan

10.1	Introduction.....	10-1
10.2	Facilities Planning and EIS Addendum.....	10-1
10.2.1	Spokane County Phosphorus Management Plan.....	10-1
10.3	Water Reclamation and Reuse Plan.....	10-2
10.4	Financing Plan.....	10-2
10.4.1	Funding Sources.....	10-2
10.5	Effluent Discharge Permitting.....	10-2
10.6	Project Delivery Approaches.....	10-3
10.6.1	Implementation of Conveyance Facilities.....	10-3
10.6.2	Implementation of Spokane County Regional Water Reclamation Facility.....	10-3
10.6.3	Refinement of Recommended Facilities.....	10-4
10.7	Environmental Documentation and Permitting.....	10-4
10.7.1	City of Spokane Special use Permit and Shoreline Substantial Development Permit.....	10-5
10.8	Implementation Schedule.....	10-7

11—Phosphorus Management Plan

11.1	Introduction.....	11-1
11.2	Target Pursuit Actions	11-1
	11.2.1 Septic Tank Elimination Program.....	11-2
	11.2.2 Treatment Technology	11-3
	11.2.3 Other Target Pursuit Actions	11-4
11.3	Projected Phosphorus Load to the Spokane River.....	11-10

List of Tables

Table ES-1	Projected Performance of Proposed SCRWRF.....	ES-11
Table ES-2	Phosphorus Load Reduction to the Spokane River Resulting from Sewer Connections of Septic Systems.....	ES-12
Table 2-1	Population and Flow Forecasts to Year 2030 (June 28, 2006).....	2-6
Table 2-2	Projected Systemwide Wastewater Flow.....	2-12
Table 2-3	Interceptor Sampling, Summary of Quarterly Sampling 1996 to 1999	2-16
Table 2-4	Wastewater Loading Summary for Nearby Communities.....	2-17
Table 2-5	Projected County Septage Loading.....	2-18
Table 2-6	Raw Wastewater Concentrations	2-18
Table 2-7	Wasteload Allocation Table from Foundational Concepts for the Spokane River TMDL Managed Implementation Plan.....	2-21
Table 2-8	Potential Effluent Quality Requirements for Discharge to the Spokane River.....	2-24
Table 2-9	Wastewater Treatment Plant Literature Summary of Polychlorinated Biphenyls (PCBs).....	2-27
Table 3-1	Redundancy Criteria for Unit Treatment Processes.....	3-10
Table 3-2	Illustration of Capital Cost Estimating Procedure	3-11
Table 4-1	Reduction in Water Demand – Public Education	4-7
Table 4-2	Reduction in Water Demand – Economic Incentives	4-7
Table 4-3	Reduction in Water Demand – Metering.....	4-8
Table 4-4	Low-Flow Fixture Requirements.....	4-9
Table 4-5	Reduction in Water Demand – Physical Devices	4-10
Table 4-6	Flow Reduction and Costs of Plumbing Fixture Replacement.....	4-11
Table 4-7	Project Water Conservation Effectiveness.....	4-12
Table 4-8	Reduction in Water Demand – Sewer Rehabilitation.....	4-14
Table 4-9	Reduction in Water Demand – Disconnect Sumps.....	4-14
Table 4-10	Reduction in Water Demand – Review Codes, Inspection, and Enforcement.....	4-15
Table 4-11	Significant Industrial Sources	4-19
Table 4-12	Estimated Water Reduction Using Water Conservation Technologies	4-23
Table 4-13	Employment Population and Phosphorus Loading in the Spokane County Wastewater Service Area.....	4-26
Table 6-1	AWT Alternative Analysis Mass Balance Summary.....	6-14
Table 6-2	Projected Performance of Proposed SCRWRF.....	6-17
Table 6-3	Projected Flows and Loadings.....	6-19
Table 6-4	Summary of Design Criteria	6-20

Table 7-1	Solids Process Loadings from Preferred Liquid Stream Alternative (Alternative 2).....	7-3
Table 7-2	Alternative B-1 Facility Requirements	7-6
Table 7-3	Biosolids Haul Truck Trips for 8 mgd Plant (assuming 12 cubic yard trucks)	7-7
Table 7-4	Estimated Annual Costs for Biosolids Handling and Land Application	7-8
Table 9-1	Summary of Estimated Capital Costs of Spokane County Regional Water Reclamation Facility	9-12
Table 9-2	Capital Costs of Outfall Alternatives.....	9-14
Table 9-3	Summary of Estimated Capital Costs of Spokane County Regional Water Reclamation Facility	9-15
Table 9-4	Summary of Projected Operation and Maintenance Costs for SCRWRf	9-16
Table 9-5	Summary of Projected Operation and Maintenance Costs for NVI and SVI Pumping Stations	9-17
Table 9-6	Projected Effluent Performance for Membrane Treatment Facility (Monthly-Average Values).....	9-17
Table 10-1	Summary of Permit Requirements.....	10-5
Table 11-1	Spokane County “Target Pursuit Actions” from the “Foundational Concepts for the Spokane River TMDL Managed Implementation Plan”	11-2
Table 11-2	Phosphorus Load Reduction to the Spokane River Resulting from Sewer Connections of Septic Systems.....	11-3
Table 11-3	Phosphorus Load Reduction through Plumbing Code Enforcement	11-5
Table 11-4	Monthly Water Demand and Phosphorus Load Reduction through Irrigation with Reclaimed Water	11-6
Table 11-5	Phosphorus Load Reduction through Reclaimed Water Irrigation.....	11-7
Table 11-6	Phosphorus Load Reduction by Accounting for Soluble, Nonreactive Phosphorus.....	11-8
Table 11-7	Phosphorus Load Reduction through Source Control Programs	11-8
Table 11-8	Phosphorus Load Reduction through Regulation of Fertilizers.....	11-8
Table 11-9	Summary of Potential Phosphorus Load Reductions to the Spokane River from Potential P Reduction Activities	11-12

List of Figures

Figure ES-1	Spokane County Utilities Service Area	ES-5
Figure ES-2	Wastewater Flow Projections	ES-6
Figure ES-3	Wastewater Flow Schematic Diagram of the Recommended Plan (Distribution Based on Spokane County Projected 2012 Flows)	ES-7
Figure ES-4	Wastewater Flow Schematic Diagram of the Recommended Plan (Distribution Based on Spokane County Projected 2030 Flows)	ES-8
Figure ES-5	Locations of Major Facilities	ES-9
Figure 2-1	Spokane Valley Interceptor Flow, January 1-15, 2006.....	2-7
Figure 2-2	North Valley Interceptor Flow, January 1-15, 2006.....	2-8
Figure 2-3	Combined Flow from Both Interceptors, January 1-15, 2006	2-8
Figure 2-4	Spokane Valley Interceptor Flow, June 1-15, 2006.....	2-9
Figure 2-5	North Valley Interceptor Flow, June 1-15, 2006	2-9

Figure 2-6	Wastewater Flow Projections	2-13
Figure 2-7	North Valley Interceptor Wastewater Characteristics	2-15
Figure 2-8	Spokane Valley Interceptor Wastewater Characteristics	2-15
Figure 4-1	Banner Bank Building (Boise, Idaho) Stormwater and Graywater Reclamation System.....	4-25
Figure 5-1	Spokane County Water Reclamation and Reuse Plan Schedule.....	5-4
Figure 6-1	Schematic of Proposed Process Design from 2003 Facility Plan Amendment.....	6-5
Figure 6-2	Schematic of AWT Alternative 1 – Membrane Bioreactor (MBR) with Nitrogen Removal and Chemical Phosphorus Removal.....	6-8
Figure 6-3	Schematic of AWT Alternative 2 - MBR with BNR and Chemical Polishing	6-10
Figure 6-4	Schematic of AWT Alternative 3 - Membrane Bioreactor (MBR) with Biological Nutrient Removal (BNR) and Tertiary Chemical Polishing	6-12
Figure 6-5	Schematic of AWT Alternative 4 – Conventional Activated Sludge with Tertiary Membrane Filtration	6-13
Figure 6-6	Schematic of Preferred AWT Alternative 2 - MBR with BNR and Chemical Polishing	6-16
Figure 7-1	Representative Liquid Treatment Process Used in Developing Sludge Quantities	7-2
Figure 9-1	Wastewater Flow Schematic Diagram of the Recommended Plan (Distribution Based on Spokane County Future Projected 2030 Flows).....	9-4
Figure 9-2	Locations of Major Facilities.....	9-4
Figure 9-3	Representative Treatment Process for the Spokane County Water Reclamation Facility (SCRWRF)	9-8
Figure 10-1	Implementation Schedule.....	10-9

List of Drawings

Drawing 2-1	Planning Area.....	2-3
Drawing 2-2	Surface and Groundwater Sources.....	2-5
Drawing 6-1	Overall Liquids Process Schematic	6-37
Drawing 6-2	Overall Solids Process Schematic.....	6-38
Drawing 6-3	Mass Balance Diagram	6-39
Drawing 6-4	Hydraulic Profile.....	6-40
Drawing 6-5	Site Layout.....	6-41
Drawing 6-6	Preliminary Site Plan	6-42
Drawing 6-7	Oblique Views of SCRWRF	6-43

Appendices

A	Foundational Concepts for the Spokane River TMDL Managed Implementation Plan (June 30, 2006).....	A-1
B	Final Onsite Sewage Disposal Systems Phosphorus Loading Estimate Technical Memorandum (June 27, 2007).....	B-1
C	Advanced Wastewater Treatment Process Evaluation Workshop (August 16, 2006).....	C-1
D	Effluent Mixing Zone Study Report for the Proposed Spokane	

Contents

2006 WASTEWATER FACILITIES PLAN AMENDMENT

E County Discharge to the Spokane River (June 21, 2004).....D-1

E Opinion of Probable Capital Cost for the Spokane County
Regional Water Reclamation FacilityE-1

F Comments on the 2006 Draft Wastewater Facilities Plan Amendment and
responses from Spokane CountyF-1

Acronyms

APA	Aquifer Protection Area
BAF	biological aerated filter
BioP	biological phosphorus
BNR	biological nutrient removal
BOCC	(Spokane County) Board of County Commissioners
BOD	biochemical oxygen demand
°C	degrees Centigrade
CBOD	carbonaceous biochemical oxygen demand
cfm	cubic feet per minute
CFR	Code of Federal Regulations; capital facilities rate
cfs	cubic feet per second
CO	contract operations
CSO	combined sewer overflow
cu yd	cubic yard(s)
CWMP	<i>2001 Comprehensive Wastewater Management Plan Update</i>
CWS	Clean Water Services
d	day
DAFT	dissolved air flotation thickener
DB	design-build
DBB	design-bid-build
DBO	design-build-operate
DBP	design-build-operate
DO	dissolved oxygen
EBPR	enhanced biological phosphorus removal
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EKO	EKO Compost
ENR	<i>Engineering News Report</i>
EPA	(U.S.) Environmental Protection Agency
ERU	equivalent residential unit
°F	degrees Fahrenheit
gal	gallon(s)
GC/CM	general contractor/construction manager
GFC	general facilities charge
GO	general obligation (bonds)
gpd	gallons per day
HARSB	Hayden Area Regional Sewer Board

Acronyms

HDR	HDR Engineering, Inc.
I/I	infiltration and inflow
IDEQ	Idaho Department of Environmental Quality
IEP	Inland Empire Paper
kwh	kilowatt-hour
L	liter
lb	pound(s)
LOCAL	Local Option Capital Asset Lending (Program)
LOTT	Lacey-Olympia-Tumwater-Thurston (County Alliance)
MBR	membrane bioreactor
mg	milligram(s)
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
MGY	million gallons per year
mL	milliliter
mm	millimeter
µg	microgram
N	nitrogen
N/DN	nitrification/dentrification
NH ₃	ammonia
NNO ₃	nitrate-nitrogen
NPDES	National Pollution Discharge Elimination System
NTU	nephelometric turbidity unit(s)
NVI	North Valley Interceptor
O&M	operation and maintenance
P	phosphorus
PCB	polychlorinated biphenyl
PLC	programmable logic controller
psi	pounds per square inch
PSRP	process to significantly reduce pathogens
PWTF	(Washington)Public Works Trust Fund
RAS	return activated sludge
RCW	Regulatory Code of Washington
RM	River Mile
RMZ	regulatory mixing zone
RO	reverse osmosis
RPWRF	(City of Spokane) Riverside Park Water Reclamation Facility

Acronyms

SBR	sequencing batch reactor
SCRWRF	Spokane County Regional Water Reclamation Facility
SEIS	supplemental environmental impact statement
SERP	(Washington) State Environmental Review Process
sq ft	square foot/feet
SRF	State Revolving Fund (Loan Program)
s.u.	standard unit(s)
SVI	Spokane Valley Interceptor
TAC	Technical Advisory Committee
TDS	total dissolved solids
TMDL	<i>total maximum daily load</i>
TN	total nitrogen
TOC	total organic compounds
TP	total phosphorus
TSS	total suspended solids
UGA	(Draft) Urban Growth Area
UV	ultraviolet
VE	value engineering
VFAs	volatile fatty acids
WAC	Washington Administrative Code
WAS	waste-activated sludge
WQAC	(Spokane County) Water Quality Advisory Committee
WQJDA	(Washington) Water Quality Joint Development Act
WRF	water reclamation facility
WWTP	wastewater treatment plant