Langley Gulch Power Plant Blowdown Water Management

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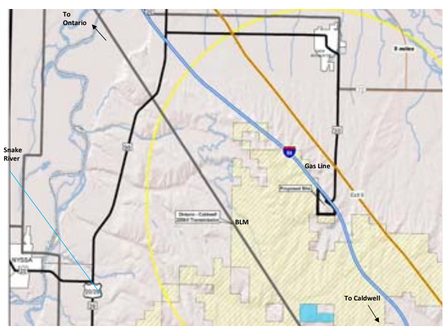
Agenda

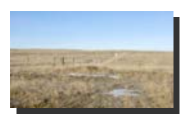
- Project Overview
- Blowdown Water Characteristics
- Site Conditions
- Project Approach
- Alternatives Analysis
- Final Decision
- Wrap-Up

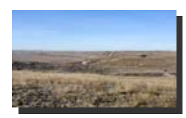
Langley Gulch Power Plant Location



Project Features

- A combined-cycle combustion turbine (CCCT) is a clean, highly efficient with two turbines – one using natural gas and the other steam
- Flexibility enables integrating wind and other intermittent generation resources
- State-of-the-art emissions control equipment minimizes impact to air quality
- Water-cooled plant is more efficient than air-cooled





Project Benefits

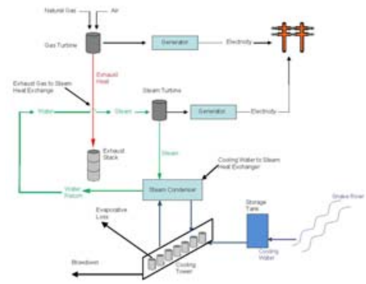
- Provides energy for growth
- Increased reliability in the Caldwell – Ontario area
- 100 to 120 construction jobs
- Use of local services, materials, and equipment suppliers – 18 personnel to operate and maintain the plant

Project Timeline

RFP process and selection	April 2008 – February 2009
PUC process	March – August 2009
Permitting	March 2009 – July 2010
Commence project construction	August 2010
Wastewater disposal in place	August 2011
Project completion	July 2012

Water Use

- Water is used in both the **steam** and **cooling** cycles
- Snake River water source



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Cooling Cycle Water Use

- Cooling cycle condenses steam into water
- Water is circulated from a cooling tower, through a condenser, and back
- Design conditions (reuse permit) ~ four cycles of concentration
  - Summer water demand was 1500 to 2000 gpm
  - 500 to 600 gpm being disposed
  - Winter water demand was 1000 to 1200 gpm
  - 300 to 400 gpm being disposed

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Snake River Source Water, Blowdown Water, and Groundwater Chemistry (mg/l)

Constituent (mg/l)	Snake River "Source Water", Nyssa, OR 9/17/93 (USGS Water Sample)*	Nyssa Calculated Blowdown Water (Source Water x4)
Alkalinity	ND	ND
Aluminum (diss.)	ND	ND
Ammonia as N	0.010	0.040
Arsenic (diss.)	0.006	0.024
Barium (diss.)	0.041	0.164
Bicarbon. Alk. As CaCO3	195.000	780.000
Boron (diss.)	ND	ND
Calcium	43.000	172.000
COD	ND	ND
Chloride	25.000	100.000
Conductivity (umhos/cm)	ND	ND
Copper (diss.)	0.002	0.008
Dissolved Oxygen	11.500	46.000
Fluoride	0.700	2.800
Iron (diss.)	0.005	0.020
Magnesium	18.000	72.000
Manganese (diss.)	0.003	0.012
Nitrate/Nitrite as N	1.200	4.800
Orthophosphate	0.092	0.368
Potassium	5.200	20.800
Selenium (diss.)	<0.001	ND
Silica (diss.)	29.000	116.000
Sodium	37.000	148.000
Sulfate	59.000	236.000
Suspended Solids	36.000	144.000
TDS	268	1,072
Total Organic Carbon	ND	ND
Total Phosphorous as P	0.070	0.280
Turbidity (N.T.U.)	6.000	24.000
pH (SU)	8.200	

*No "dissolved" noted on report
ND – No data

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Options for Blowdown Management

- Original design
  - Water from Snake River
  - Blowdown to evaporation pond ~ 23 Acres
- Initial alternate design
  - Discussions with IDWR / IDEQ
  - Injection wells
  - Significant cost savings to project
- Additional alternatives – multiple reuse scenarios
  - Significant cost savings to project
  - Utilizing water vs. evaporation

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Comparison of Primary Constituents For Blowdown Water (mg/l)

Constituent	Ground Water Rule MCL	Langley Gulch	Idaho National Labs	Raft River
Arsenic	0.05	0.002	0.00328	0.025
Barium	2.0	0	0.09881	ND
Copper	1.3	0.031	0.00385	ND
Fluoride	4.0	2.0	0.27	5.2
Total Nitrogen	10.0	5.0	2.7	0.95
Selenium	0.05	0.003	0.00189	ND
Average Annual Flow	–	240 MG/year	250 MG/year	210 MG/year

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*Comparison of Secondary Constituents For Blowdown Water (mg/l)

Constituent	Ground Water Rule MCL	Langley Gulch	Idaho National Labs	Raft River
Aluminum	0.2	1.55	0.01756	ND
Chloride	250	93	23.73	1,322
Iron	0.3	1.0	0.05403	15.02
pH	6.5 – 8.5	8.0	7.88	7.94
Sulfate	250	610	263	198
TDS	500	1,062	627	2,840

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IDEQ Pre-Application Meeting

- Reviewed project objectives
- Reviewed existing permitted reuse projects
- Identified applicable programs and rules
- Discussed site-specific data for evaluating compliance
- Examined downgradient users/beneficial uses

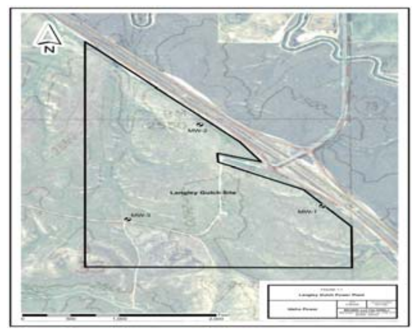
Key Idaho Regulations

- *IDAPA 58.01.11* – Groundwater Quality Rule
  - "Activities with the potential to degrade aquifers shall be managed in a manner which maintains or improves existing groundwater quality…"
- *IDAPA 37.03.03* – Rules and Minimum Standards for the Construction and Use of Injection Wells
  - "The concentration of each chemical contaminant in the injected fluids shall not exceed the groundwater quality standard for that chemical contaminant…"

Data Collection Approach

- Monitor Wells – Subsurface geologic and hyrdrogeologic information, water quality, and groundwater flow direction
- Aquifer stress testing
- Utilize groundwater mixing model
- Utilize IDEQ numerical model
- Utilize MODFLOW and MT3D simulations

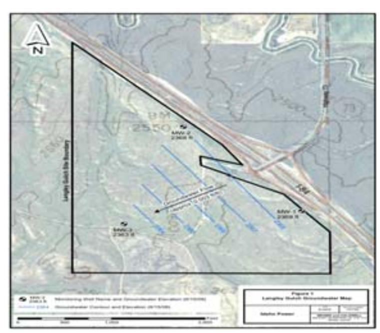
Monitor Well Location Map



Site Hydrogeology

- Site is approximately eight miles south of the Payette River and occurs in the uplands immediately south of the river valley
- Depth to first water 185 feet bgl
- Two aquifers identified – upper unconfined aquifer 50' thick and a deeper confined aquifer
- Interbedded clay, silt, and sand
- Groundwater flow assumed to be north-northwest but was found to be southwest – possibly influenced by A-Line canal

Water Table Contour Map



Groundwater Quality (mg/l)

Constituent	Blowdown Water	Shaw Well	MW-1	MW-2	MW-3
Alkalinity	ND	100.0	87	150	120
Aluminum	ND	<0.1	<0.1	<0.1	<0.1
Ammonia	0.040	<0.1	0.15	0.25	<0.1
Arsenic	0.024	<0.02	<0.02	<0.02	<0.02
Barium	0.164	0.082	0.019	0.018	0.064
Bicarbonate	780.000	100.0	87	70	120
Boron	ND	<0.2	<0.2	<0.2	<0.2
Calcium	172.000	28.0	20	27	30
COD	ND	<10.0	24	80	67
Chloride	100.000	10.0	4.3	11.0	7.6
Conductivity	ND	250.0	200	370	300
Copper	0.008	<0.02	<0.02	0.059	0.041
DO	46.000	4.31	8.95	9.26	8.81
Fluoride	2.800	0.38	0.33	0.44	0.36
Iron	0.020	0.27	<0.1	<0.1	<0.1
Magnesium	72.000	5.4	4.0	9.0	8.0
Manganese	0.012	0.13	0.03	0.018	0.085
Nitrate	4.800	<0.1	0.17	0.28	0.8
Orthophosphate	0.368	0.036	<0.12	0.63	2.3
Potassium	20.800	2.0	2.0	4.2	3.1
Selenium	ND	<0.02	<0.02	<0.02	<0.02
Silica	116.000	19	13	7.9	16
Sodium	148.000	15.0	31	56	26
Sulfate	236.000	23	14	36	22
TSS	144.000	1.0	640	1,000	610
TDS	1,072	200	160	420	220
TOC	ND	1.2	1.9	7.1	6.9
Phosphorous	0.280	<0.1	0.16	0.5	0.39
Turbidity	24.000	2.2	420	820	810
pH	ND	7.7	7.9	8.6	8.0
Strontium	ND	0.2	0.099	0.12	0.22

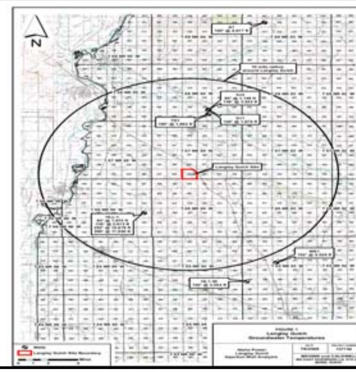
Alternatives Evaluated

- Injection (shallow (first water) and deep)
- Infiltration
- Infiltration with land application
- Zero discharge evaporation pond

Injection Description

- Injection into uppermost aquifer (first water) or deeper (1,000+ feet bgl) aquifer
- Multiple wells required to accommodate 450+ gpm flow
- Water compatibility
- Regulated by IDWR at wellhead

Deep Test Wells with Groundwater Temperatures



Injection Results

- Approach is not viable for shallow injection due to water quality impacts at the POC/wellhead
- Deep injection test well >$100,000 with no certainty of permit issuance, thus no further evaluation
- Permit application and review time frame – could impact project schedule
- Long-term groundwater monitoring would be required

Infiltration Description

- Year-round operation
- Groundwater modeling necessary
- Wastewater reuse permitting program
- Groundwater quality rule

Infiltration Evaluation

- Infiltrate into three – 1.5 acre basins (one back-up)
- NRCS soil information – soils suitable
- MODFLOW groundwater model – 30’ water table mounding
- MT3D contaminant fate and transport model results indicate TDS @ 900 mg/l reaches point of compliance (property boundary)
- Modeling projected high TDS concentrations over 0.5 mile from point of compliance (property boundary)
- No permit assurance

Infiltration with Land Application Description

- Similar to infiltration with summer irrigation
- Pressure irrigation from storage pond
- Groundwater monitoring requirements

Infiltration with Land Application Evaluation

- NRCS soil data – soils suitable for infiltration
- Irrigation on two swaths adjacent to plant
- IDEQ technical services division numerical models – TDS not consumed by plants, actually increases due to surface evaporation
- MODLOW groundwater model – 30’ water table mound
- MT3D contaminant fate and transport model – TDS reaches POC at 900 mg/l
- Surface slopes – steep slopes will affect irrigation application rates
- No permit assurance

Zero Discharge Evaporation Pond Description

- Common method for blowdown water management
- Year-round storage and evaporation in lined pond
- System allows more cycles for cooling
- Additional RO system is necessary

Zero Discharge Evaporation Pond Evaluation

- Wastewater permit *unnecessary* with no discharge
- No groundwater monitoring required
- Flow balance re-evaluation indicates 12 acre pond necessary

Alternatives Summary

Alternative	Advantages	Disadvantages
Injection	▪Aquifer recharge ▪Minimal system space requirements ▪Relatively low capital and operating costs	▪Potential for off-site leachate migration ▪Permit required – 10 year period maximum ▪Long-term monitoring likely ▪Permit Uncertainty
Infiltration	▪Aquifer recharge ▪Minimal system space requirements ▪Relatively low capital and operating costs	▪Potential for off-site leachate migration ▪Long-term monitoring likely ▪Permit required – good for five years ▪Permit uncertainty
Infiltration with Land Application	▪Same advantages as above ▪Aesthetics ▪Potential revenue stream	▪Potential for off-site leachate migration ▪Long-term monitoring likely ▪Permit required – good for five years ▪Maintenance during crop establishment ▪Permit Uncertainty
Evaporation Pond	▪No permit required ▪Groundwater monitoring unlikely ▪Minimal pond O&M ▪Reduced overall water use	▪Treatment system O&M ▪Relatively high capital and RO operating costs ▪Large area required for pond ▪No beneficial water use

Final Decision

- Timing of permit and permit assurance was the "driver"
- IPC moving forward with pre- and post-treatment systems with evaporation pond
  - Cycles of concentration has been increased to nine
  - Reduces water demand from nearly 2000 gpm peak to 1300 gpm peak
  - Reduced pond size to 12 acres
  - Blowdown water management costs have increased

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