Buckhorn Mountain Mine, Washington

Photo: http://www.mining-technology.com/projects/kinross-buckhorn/kinross-buckhorn2.html

Buckhorn Mountain Mine

- North central Washington State – Okanogan Valley
- Underground gold mine
- Ore trucked to Republic, WA – tailings
- Originally planned for open pit
- 59% potentially acid-generating waste rock
- Settlement with Kinross – agreement for independent monitoring with Okanogan Highlands Alliance

Independent Monitoring Goal

- Provide input about the adequacy of the hydrogeologic and water quality monitoring of the mine and associated mitigations
- Suggest modifications to monitoring and adaptive management plans that will help ensure protection of the environment

Background and Timeline

Date	Event
Sep-06	Construction of Buckhorn Mine began
Fall 2007	Dewatering began
Jan-09	Development rock excavation began; discharge to Outfall 002 began
Mar-08	First annual meeting and reporting due (missed)
Apr-08	Okanogan Highlands Alliance (OHA) and Kinross/Crown Resources (Kinross) agreement
Jul-08	Discharge to Outfalls 003 and 004 began
Nov-08	First meeting with WDOE, WDFW, Kinross, and OHA
Apr-09	Second annual meeting with WDOE, WDFW, Kinross, and OHA

DEPARTMENT OF ECOLOGY
State of Washington

News Release

FOR IMMEDIATE RELEASE – April 28, 2009
09-092

Buckhorn gold mine fined $40,000 for violating water quality permit

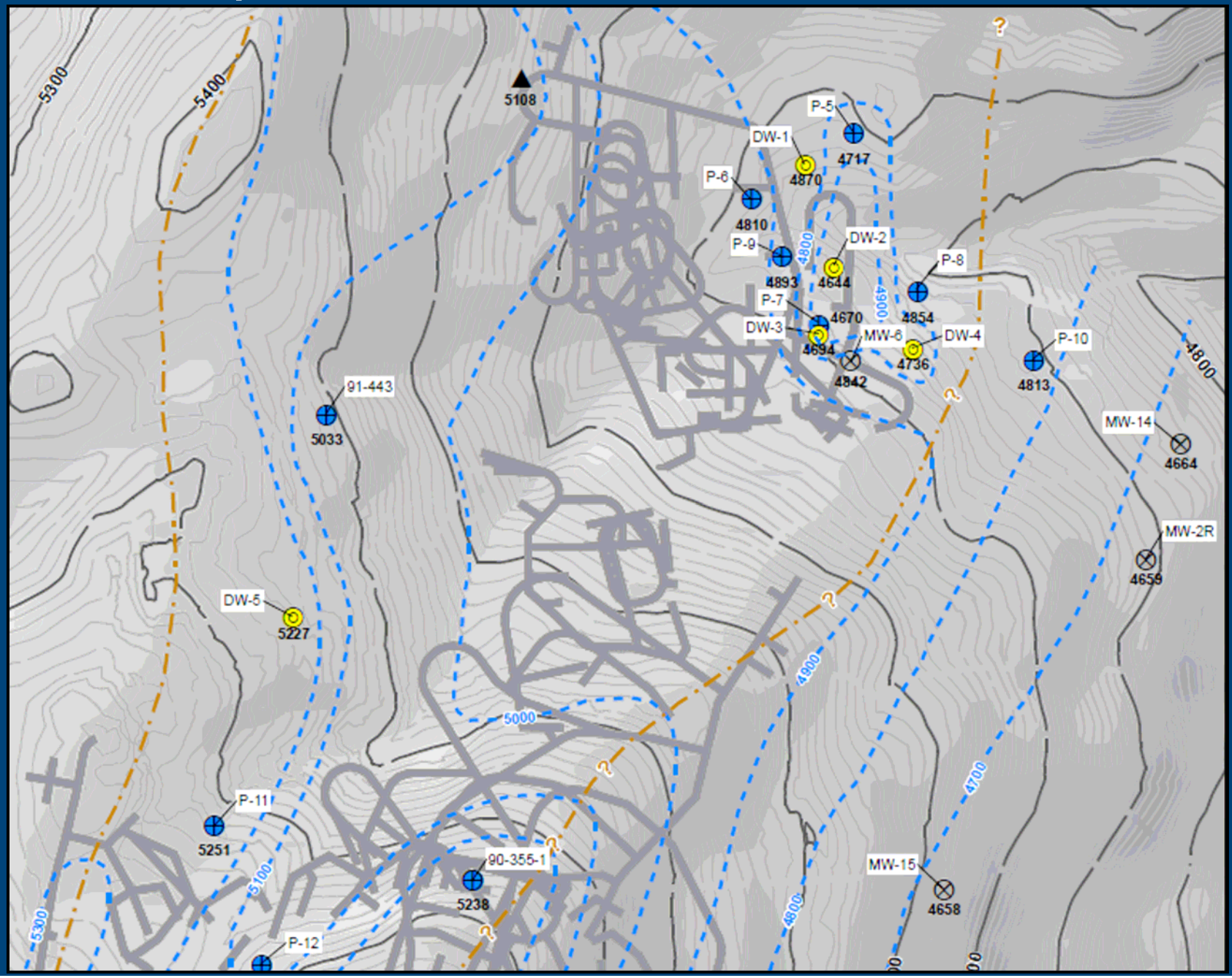
YAKIMA – Crown Resources Corporation has been fined $40,000 for violating its water quality permit at the Buckhorn Mountain gold mine near Republic, Wash., in Okanogan County.

The Washington Department of Ecology (Ecology) has cited the company for failing to adequately capture and treat water from the mine operation, violating the company's NPDES (National Pollutant Discharge Elimination) permit. The mine discharges treated mine water and stormwater to both surface and groundwater, including Gold Bowl, Nicholson, and Marias creeks.

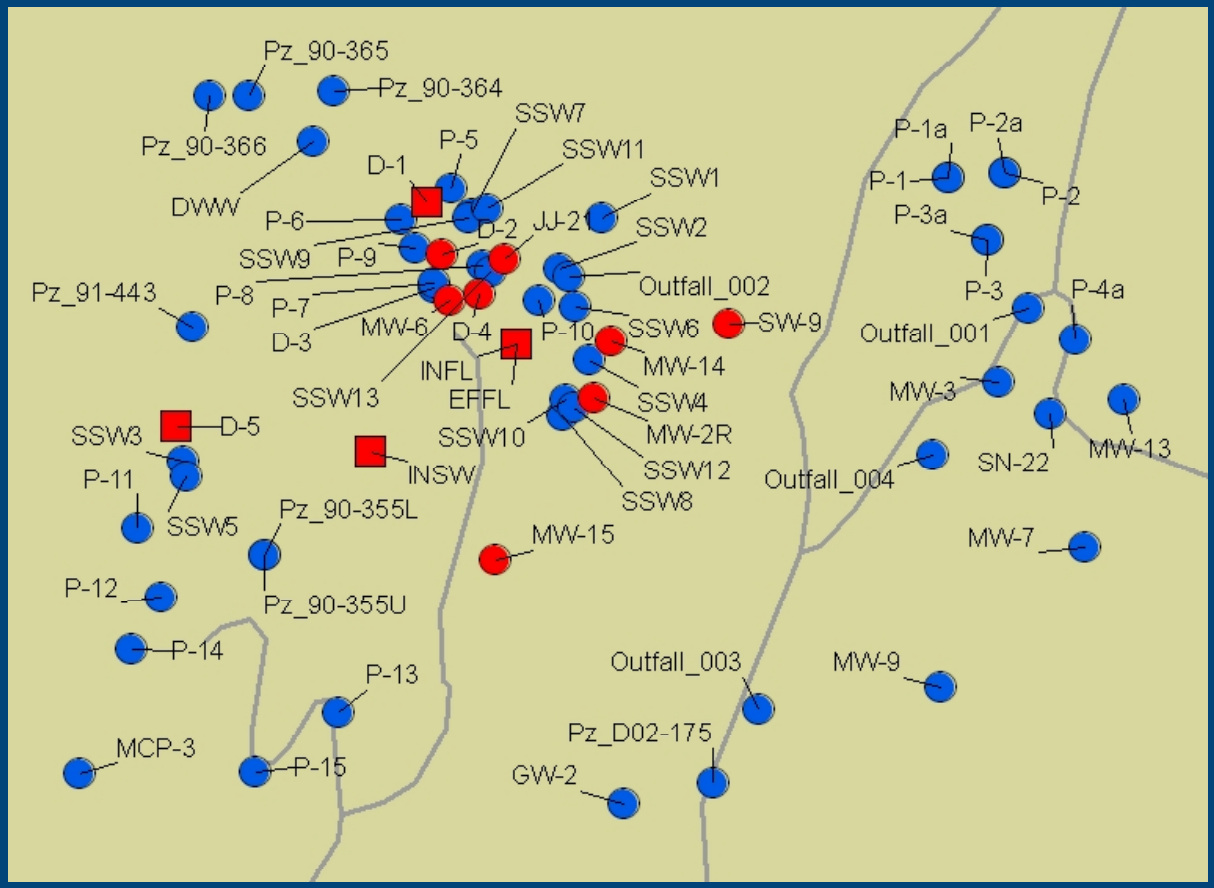
Ecology's interpretation of data indicates seepage from the mine workings has been detected in groundwater monitoring wells, and stream samples and springs downstream from the mine.

Capture Zone?

Golder Assoc., Mar. 2009

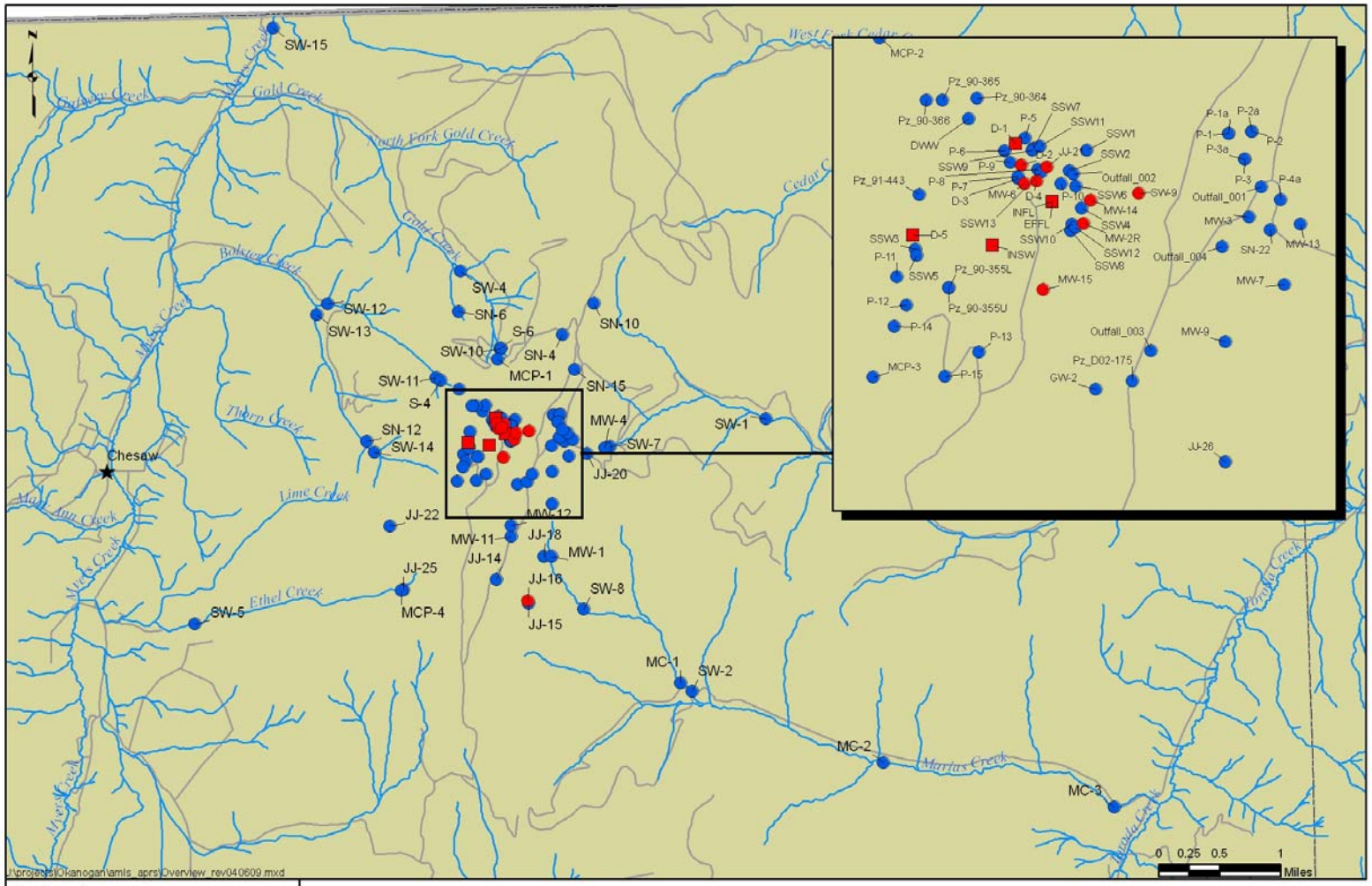


Mine Site – Elevated Nitrate/Ammonia



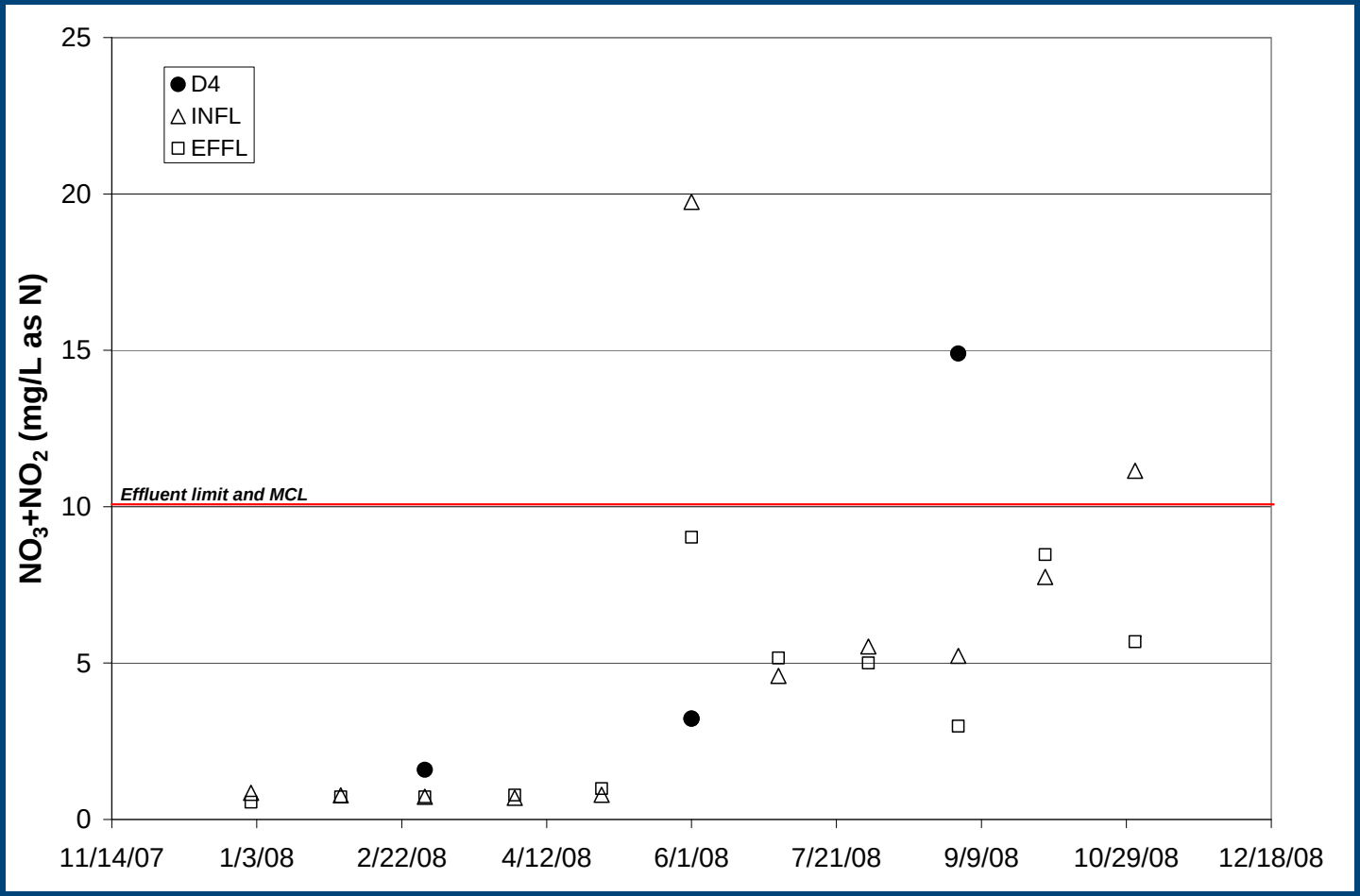
Stratus Consulting, 2009

Locations with Elevated Nitrate and/or Ammonia Concentrations



Stratus Consulting, 2009

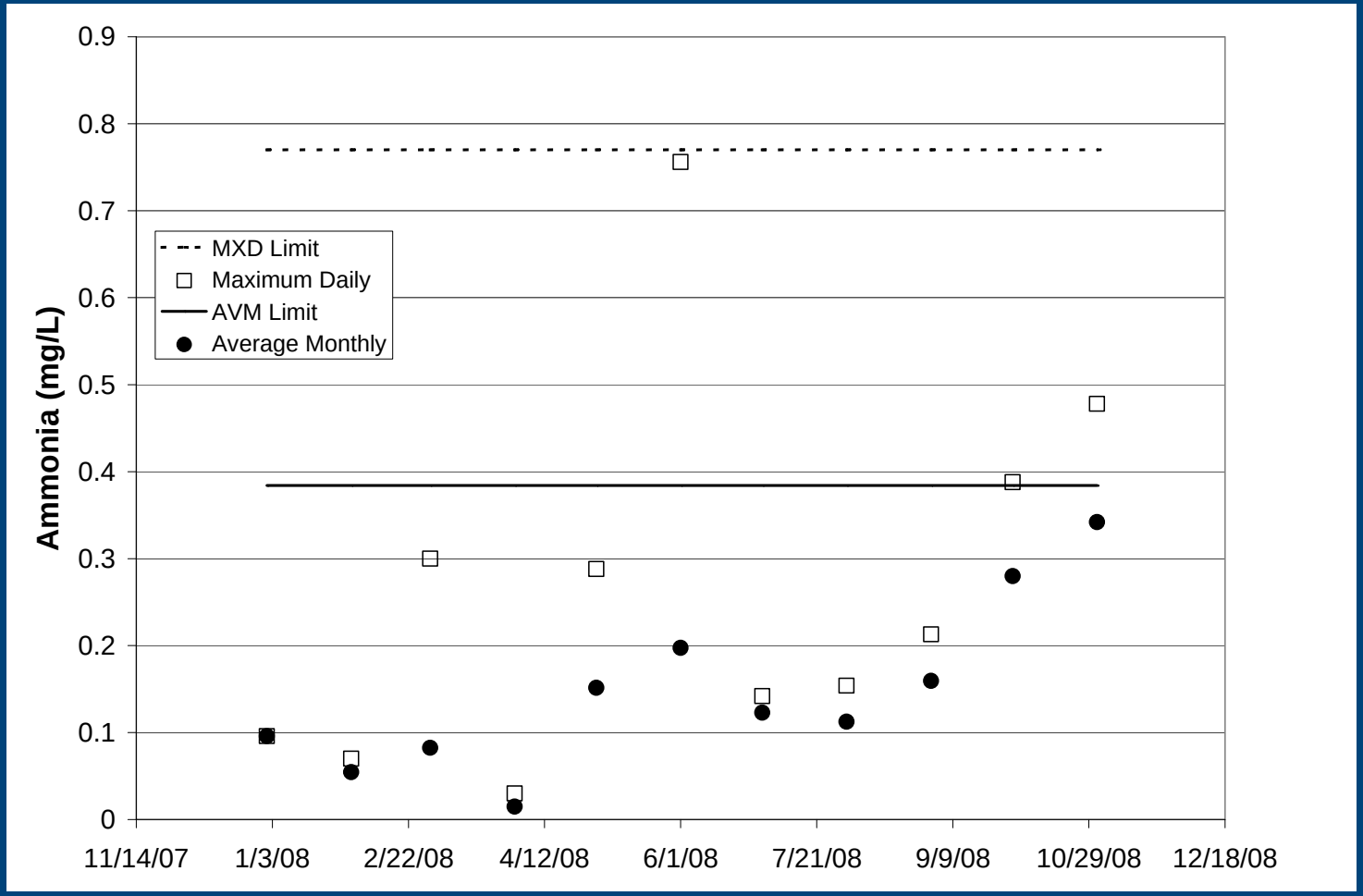
Increasing Nitrate Concentrations



INFL = WWTP influent from mine; EFFL = WWTP effluent to streams, groundwater

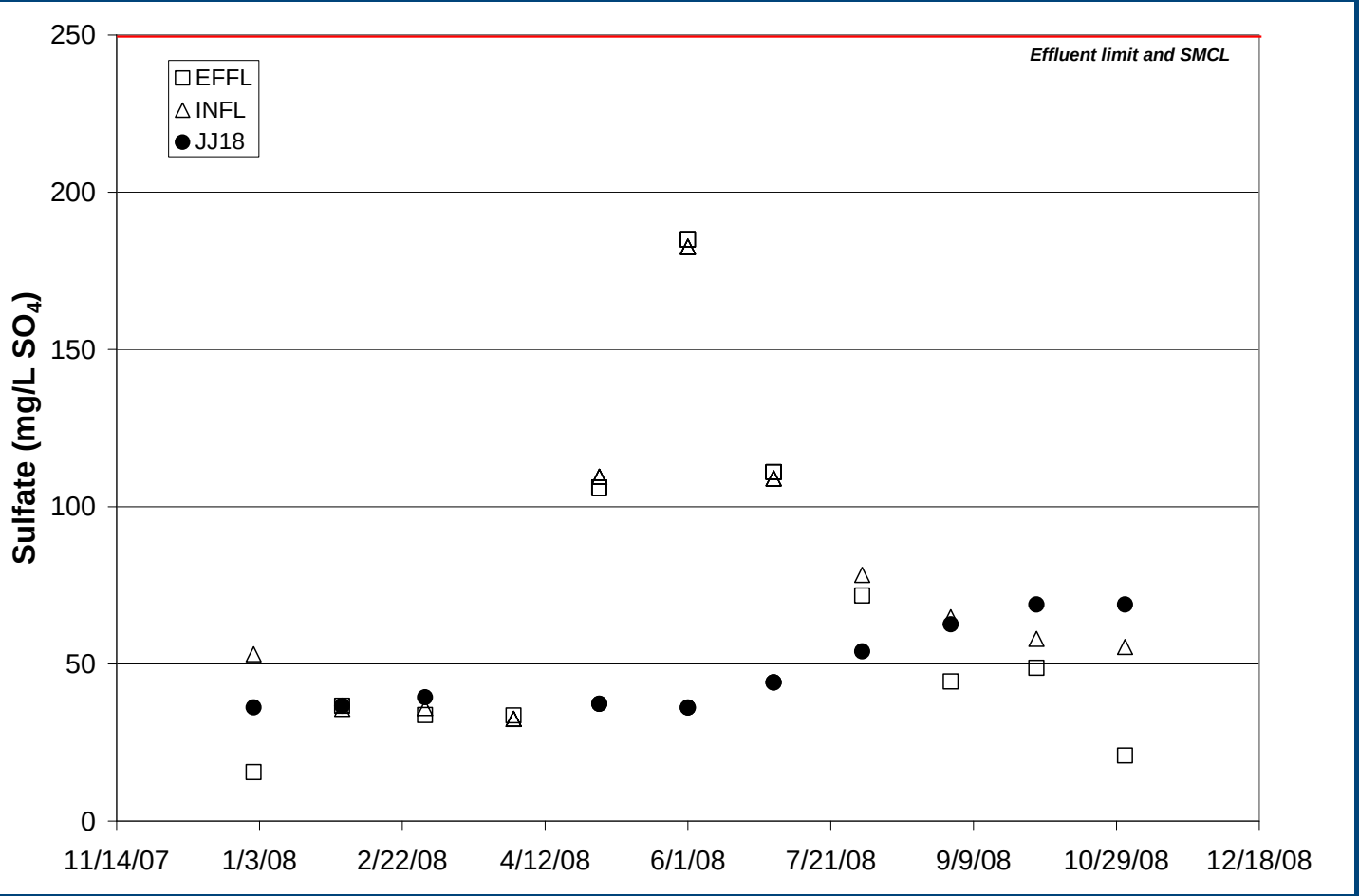
Data from Washington Dept. of Ecology website

Increasing Ammonia in Effluent



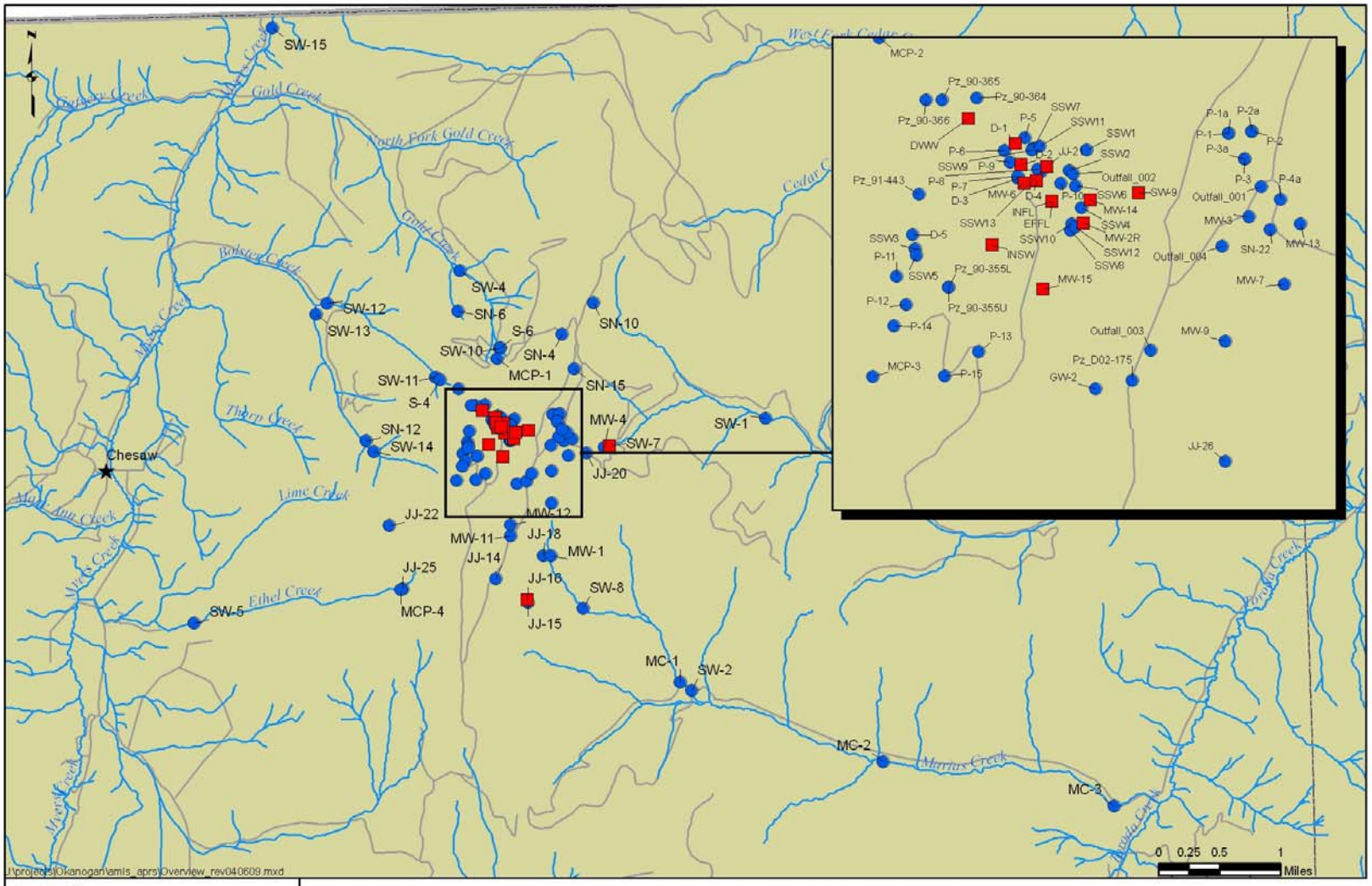
Data from Washington Dept. of Ecology website

Increasing Sulfate Concentrations



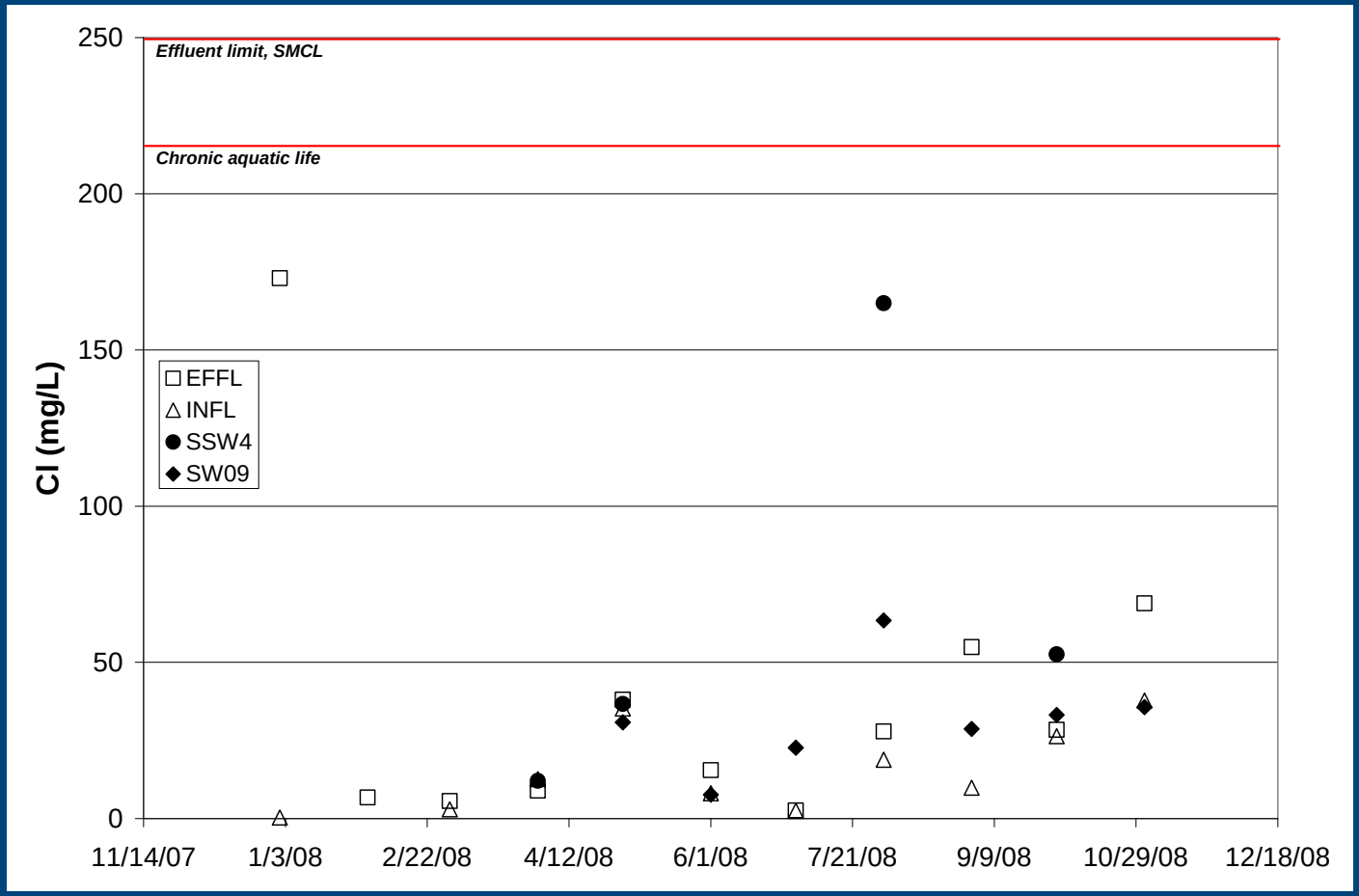
Data from Washington Dept. of Ecology website

Locations with Elevated Sulfate Concentrations



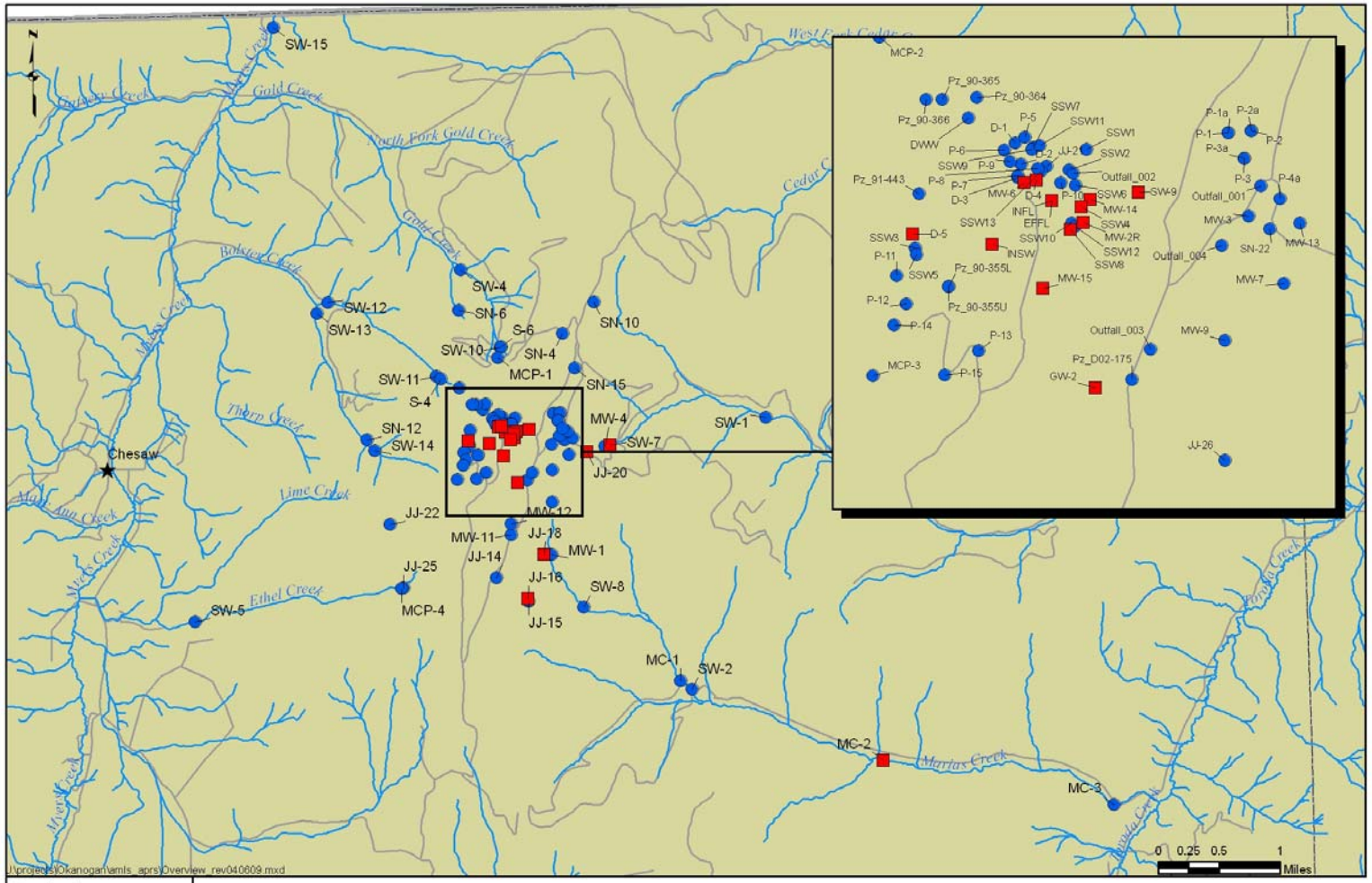
Stratus Consulting, 2009

Increasing Chloride Concentrations



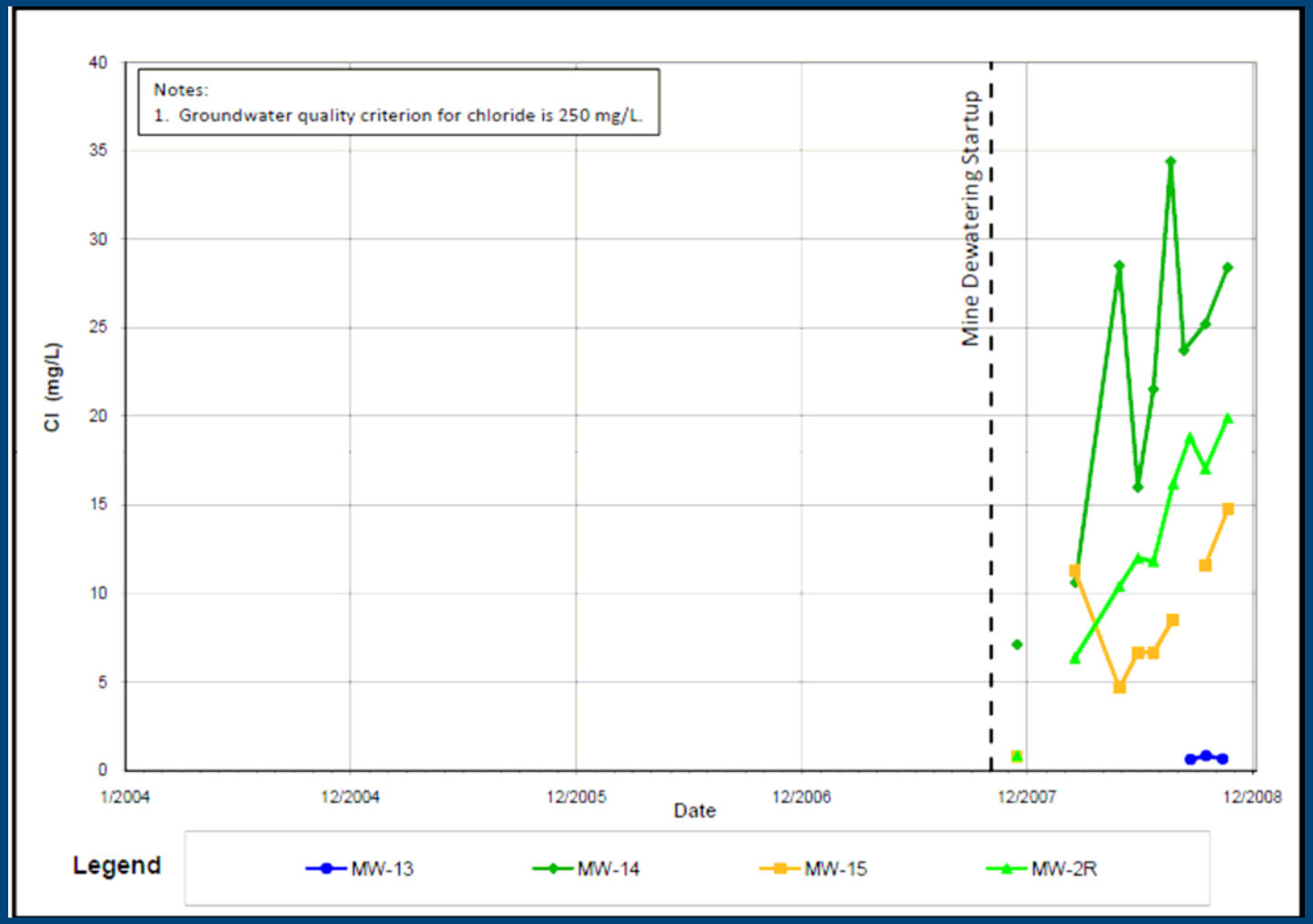
Data from Washington Dept. of Ecology website

Locations with Elevated Chloride Concentrations



Stratus Consulting, 2009

Increasing Chloride in Groundwater Outside Capture Zone



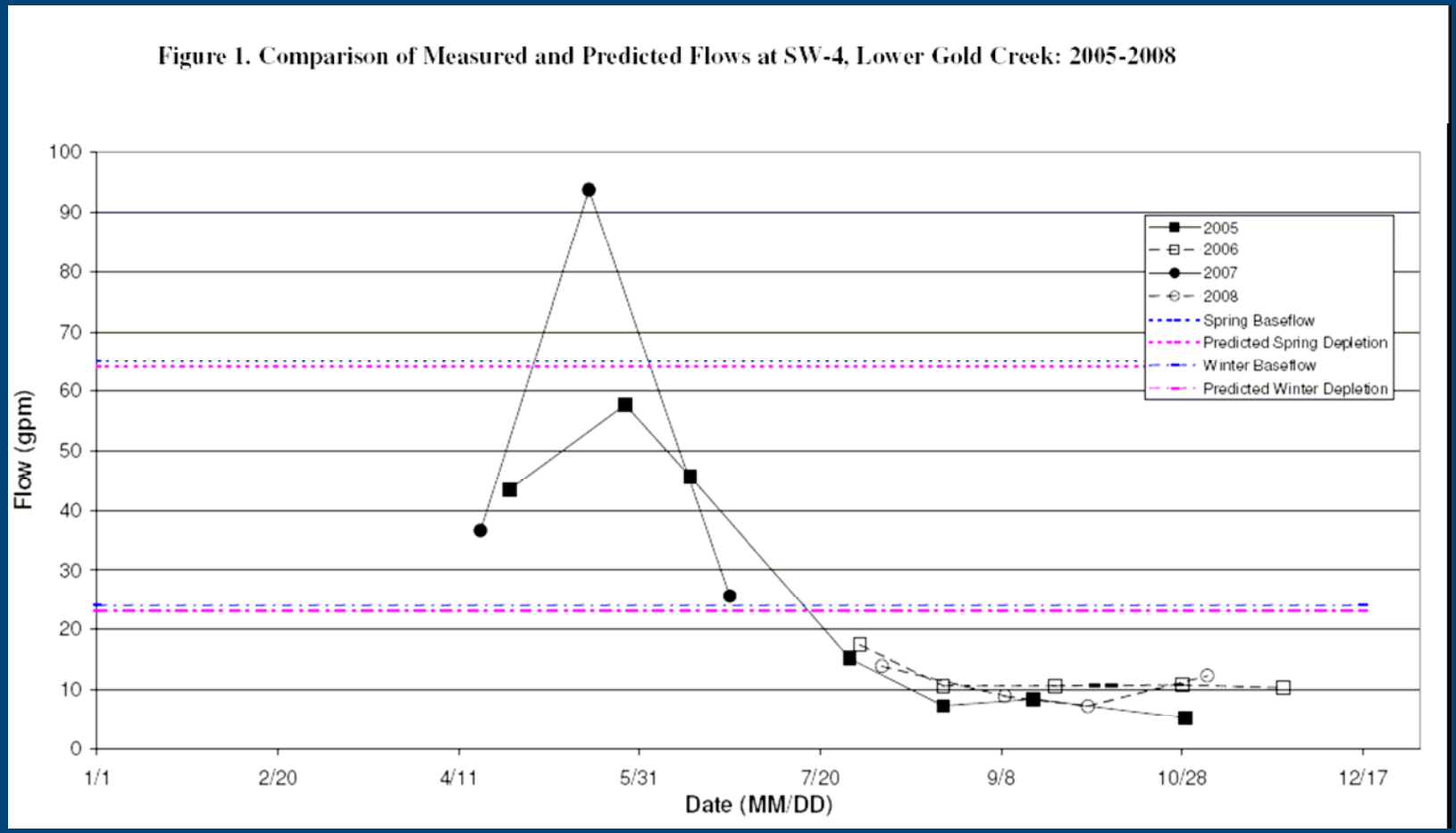
Golder Assoc., Mar. 2009

Mine Inflow Water Quality: Measured vs. Predicted

- Southwest Zone (bold >2x; yellow>10x)
  - **Sulfate**, **aluminum**, arsenic, **fluoride**, **lead**, **manganese**, **nitrate**, and **zinc** higher than predicted
  - Compared to Revised Worst Case for Southwest Zone Operational, Table 6 Engineering Report
- Makes treatment more difficult than expected

Measured vs. Predicted Flow Issues

- Measured low flows (fall/winter) are often substantially lower than modeled baseflows
- FEFLOW model does not adequately simulate pre-mining conditions
- Need precipitation data from the mine and historic streamflows as input to model



Modeled low flows are substantially larger than the measured flows

Stratus Consulting, 2009

Summary

- Increased nitrate, ammonia, chloride in groundwater related infiltration of treated effluent from surge pond and outfall 002 infiltration trench
- Increased sulfate related to oxidation of sulfides from blasting and mining
- Capture zone isn't capturing all mine water - violation
- Actual water quality in treatment plant inflow is much higher than predicted
- Measured flows in streams are often higher than predicted – need on-site meteorological station
- Need to increase dewatering and monitoring wells to improve capture