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Transmission Memo

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Subject: Mt. Shasta Springs Vulnerability Rating and Water Year Forecasting

Vulnerability Rating

The attached matrix identifies and describes each spring that was included in the springs study, as well as outlines the discharge/recharge elevations for all the springs and rates each spring for potential vulnerabilities. There are numerous vulnerabilities any given spring may poses, however for the purposes of this exercise, the vulnerabilities were limited to Water Quality, Water Usage, and Climate Change impacts. Each spring is given a score for vulnerability within each of the three criteria with 5 being vulnerable to 1 being not vulnerable.

1. "Water Quality" vulnerability is defined as any potential for the spring to become contaminated by sediment, nutrients, heavy metals, hydrocarbons, etc. This includes contamination within the recharge area (septic infiltration, leaking gas tanks, etc), run-off directly into spring or spring channel, which primarily consist of sedimentation from erosion (often associated with logging, road building, development).
2. "Water Usage" vulnerability could be associated with any development within the springs recharge area, above the discharge point, or below the discharge point that results in a net reduction in water available for ecological uses. This can include residential, industrial, agricultural, or community use of water from the spring resource.
3. "Climate Change" vulnerability is associated with the potential impact to spring production due to reduced snowpack within the recharge area. It was assumed that springs with lower recharge elevations or local recharge area (close to the discharge point) may be vulnerable to climate change impacts and higher recharge elevation or longer residence time may be less vulnerable.

Forecasting

A forecasting component to predict drought conditions for specific springs that supply valuable water for communities and fisheries resources was also planned. However, the GAMA (Groundwater Ambient Monitoring Assessment) age data necessary for this effort will not be available until 2012. The available snowpack data needed for forecasting has already been obtained and once the age data is available, this effort can be completed.

Mt. Shasta Spring Vulnerability Rating

Spring Name	Watershed	Description	Discharge Elevation (ft)	Calculated Recharge Elevation (ft)	Potential Vulnerability (5= Vulnerable and 1= Not vulnerable)			Total Vulnerability Index	Vulnerability Explanation
					Water Quality	Water Use	Climate Change		
Muire	McCloud	Emerging on the McCloud River along wide bank area. Large recharge area.	2983	**6039**	1	1	3	**5**	With larger recharge area the spring is considered not vulnerable to WQ contamination or substantial water use. However the short residence time and low recharge elevation may make the spring slightly more vulnerable to climate change (due to reduced snowpack).
Mt. S Big Spring	Sacramento	Known as the headwaters for the Upper Sacramento River, discharging at the Mt. Shasta City Park. High recharge elevationand long residence time.	3567	**8170**	2	3	1	**6**	With the spring emanating near the City of MS, the spring may be vulnerable to WQ contamination due to leaky sewer pipes, etc and the large water bottling facility up gradient could impact production of the spring. The high recharge elevation could make the spring less vulnerable to climate change.
McBride	Sacramento	Small spring located in McBride campground off Everitt Memorial Highway. Discharging from two 4-inch pvc pipe.	4969	**7408**	1	1	2	**4**	The location of the spring in relation to development, the production rate, and recharge elevation makes the spring less vulnerable in all categories.
East Squaw Valley Spring	McCloud	Small spring discharging directly into Squaw Creek.	3104	**5654**	4	3	4	**11**	With the spring emanating close to McCloud (down gradient of sewer ponds) and with it's lower recharge elevation, the spring has greater vulnerability in all categories.
McCloud Soda Spring	McCloud	Soda spring discharging into Squaw Valley Creek. Deep residence and contact with Marine Metasedimentary rocks.	2992	**5714**	2	1	4	**7**	McCloud Soda Springs has a lower vulnerability for WQ contamination and water use due to it's deep travel path, however the lower recharge elevation may make it susceptible to climate change.
Widow	McCloud	Discharges on the Mt Shasta Forest Subdivision property, unknown if spring channel is tributary to any other stream. Local recharge area, snow pack source likely.	4675	**5676**	3	3	4	**10**	The location of this spring (and it's suspected recharge area) in relation to logging activities and residential development make it slightly more vulnerable to WQ and usage concerns. It's lower recharge elevation also make it more vulnerable to climate change .
Bundora	McCloud	Small spring discharging on the banks of the upper McCloud River. Low recharge elevation.	3616	**5166**	2	1	4	**7**	The location of this spring suspected recharge area in relation to logging activities make it slightly more vulnerable to WQ concerns. It's lower recharge elevation also make it more vulnerable to climate change.
Black Butte	Shasta	Several small springs located east of railroad near south Weed.	3612	**7334**	2	3	2	**7**	The location of this spring in relation to the railroad and other planned commercial development make it more vulnerable to WQ and usage concerns. The higher recharge elevation reduces potential vulnerability to climate change.
Trout Camp	Sacramento	A developed spring emanating from the mountainside above the Sacramento River. Local recharge mixing.	2753	**6279**	3	3	3	**9**	This spring is suspected to have low/local recharge , making it more vulnerable to WQ (close to I-5) and climate change concerns.
Carrick Spring	Shasta	Slightly thermal spring emerging in Carrick Park. Long residence time and high mineral content. Highly utilized by agricultural diverters downstream.	3531	**8464**	1	5	1	**7**	Carrick spring has low vulnerability for WQ and climate change concerns due to it's high recharge area. The water usage concern is significant due to agricultural diversions downstream (over adjudicated).

Mt. Shasta Spring Vulnerability Rating

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					Water Quality	Water Use	Climate Change		
Boles Creek/Kellog Spring	Shasta	Small undeveloped slightly thermal spring emerges behind Weed High School and enters Boles Creek. Boles Creek is highly utilized by Roseburg, City of Weed, and ag diverters.	3563	**8682**	1	5	1	**7**	Bole/Kellog spring has low vulnerability for WQ and climate change concerns due to it's high recharge area. The water usage concern is significant due to community, industrial and agricultural diversions downstream (over adjudicated).
Beaughton	Shasta	Developed spring located behind Weed High School. Consistent flow, which is highly utilized by water bottling facility and agricultural diverters.	3438	**8142**	1	5	1	**7**	Beaughton spring has low vulnerability for WQ and climate change concerns due to it's high recharge area. The water usage concern is significant due to industrial and agricultural diversions downstream (over adjudicated).
Cold Creek/Howard	Sacramento	Spring is highly developed and utilized by the City of Mt. Shasta. Flow fluctuate slightly throughout year, with summer production being the greatest.	4167	**7291**	1	4	3	**8**	Cold Creek Spring has low WQ vulnerability due to it's discharge and recharge location/elevation. The water usage vulnerability is significantly higher due to community usage, as it meets or exceeds summer production rates. The climate change vulnerability is slightly higher due to it's relatively local recharge area.
Big Canyon Creek/Bear Spring	Sacramento	Small spring located along Bear Springs Road. Spring is developed and diverted for use by a small water district. Spring was noted to dry in spring and fall.	4971	**7294**	1	3	4	**8**	Bear Springs has low WQ vulnerability due to it's discharge and recharge location/elevation. The water usage vulnerability is significantly higher due to downstream usage. The climate change vulnerability is slightly higher due to it's relatively local recharge area.
McGinnis	McCloud	Spring complex emanating from a hill side near the Mt. Shasta Ski Park.	3711	**6508**	4	3	4	**11**	McGinnis is located in near the Ski Area, making it more vulnerable to WQ and usage concerns. The climate change vulnerability is slightly higher due to it's relatively local recharge area.
Esperanza	McCloud	Small spring which flows into a meadow area in the McCloud flats. Lower elevation recharge area, snowpack sourced.	3437	**5054**	3	1	4	**8**	Esperanza is more vulnerable to water quality and climate change concerns due to it's low recharge elevation.
Elk	McCloud	Two discharge locations are known as Elk Spring, both highly developed and utilized by McCloud Community Service District	3713	**6179**	3	4	3	**10**	Elk Springs is slightly more vulnerable in all aspects due to it short residence time, local recharge area, high usage and recharge area likely in close proximity to logging activities.
Intake	McCloud	Spring is highly developed and utilized by McCloud Community Service District	4607	**6435**	1	4	4	**9**	Intake is highly utilized making it more vulnerable to usage concerns and has a very local recharge area making more susceptible to climate change impacts.
Upper Soda Spring	Sacramento	Soda spring located above Tahlindali Park in Dunsmuir. Very small flow with long residence time.	2157	**3656**	2	1	4	**7**	Upper Soda Springs has a lower vulnerability for WQ contamination and water use due to it's deep travel path, however the lower recharge elevation may make it susceptible to climate change.

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					Water Quality	Water Use	Climate Change		
Other Springs of Interest (not included in original study)									
Shasta Big Springs	Shasta	Large spring complex located off of Louie Road in Shasta Valley. Highly utilized by Ag diverts and significant source of cold water for the Shasta River.			3	5	2	**10**	Shasta Big Springs are very vulnerable to usage concerns due to the agricultural diversions. They are suspected to be slightly thermal springs, meaning long residence time and high recharge elevations, making the springs less vulnerable to climate change impacts. Any local recharge mixing could impact WQ due to local pesticide use.
McCloud Big Springs	McCloud	Discharges directly into McCloud River, emanating from eroded escarpment on the Hearst Property			1	1	3	**5**	With larger recharge area the spring is considered not vulnerable to WQ contamination or substantial water use. However the short residence time and low recharge elevation may make the spring slightly more vulnerable to climate change (due to reduced snowpack).
Panther Meadow Spring	Sacramento	Small spring located on Mt. Shasta in Panther Meadow. Recently renovated to accommodate the high visitor traffic. Drying in recent years.			1	1	4	**6**	Panther Meadow Spring is not vulnerable to WQ or usage impacts due to location/elevation of recharge and discharge (within Wilderness area). The likely local recharge area, could make the spring more susceptible to climate change impacts.