FEMA Hazards Loss Modeling Task Force (MOTF)

Situation Report

#14

Colorado Spring Flood Risk

FINAL REPORT

FEMA Modeling Task Force (MOTF)
Denver Federal Center, Building 710A
Denver, Colorado 80225

Email: FEMA-MOTF@fema.dhs.gov
Phone: (303) 235-4302

1700 MDT 06/19/2014 to 1700 MDT 06/26/2014

1. Incident Name	2. Operational Period (Date/Time)	3. Date Prepared	4. Report No
Potential Spring Flooding	1700 MDT 06/19/2014 to 1700 MDT 06/26/2014	06/26/2014	14

5. Type of Incident: Snowmelt Flooding (Potential)

6. Incident Location: Northeast Colorado

7. Incident Map(s): See below **FEMA GeoPlatform Event Page:** http://bit.ly/1lKClRX

8. Data Downloads:

All FEMA MOTF Situation Reports for this event are located:
http://content.femadata.com/GISData/MOTF/Colorado_Flood_Outlook_2014/MOTF%20Situation%20Reports/

FEMA MOTF Event FTP Link:
http://content.femadata.com/GISData/MOTF/Colorado_Flood_Outlook_2014/

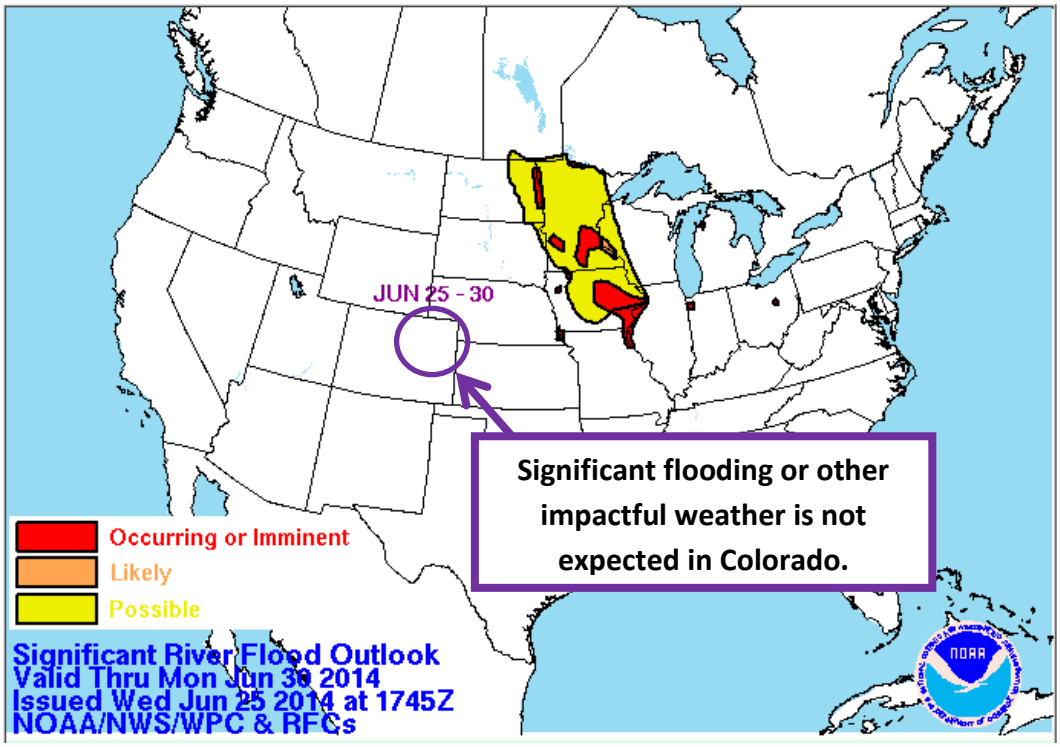
Colorado Water Conservation Board (CWCB) Flood Threat Portal (public information website):
http://www.coloradofloodthreat.com/

NATIONAL WEATHER SERVICE

Significant River Flood Outlook

Click a region on the national map below to access more detailed RFC data.

View the River Flood Outlook for Alaska



National Weather Service (valid through June 30, 2014)

9. Current Situation:

- **The snowpack on the Colorado Rocky Mountains is above average and represents an enhanced risk for snowmelt flooding—only about 4 percent of the 2014 snowpack remains in the South Platte Basin (USDA-SNOTEL 6/26/14):**:
    - **Mountain snowpack in the South Platte River Basin is about 4 percent of seasonal peak, with snowcover at SNOTEL sites falling to about less than one (1) inch of snow-water equivalent remaining to melt (USDA-SNOTEL 6/26/14)**
    - Normal peak snowpack date for the South Platte River Basin is April 26: the snowpack leveled off in April and rapidly melting in June—melting off earlier than the 2011 snowpack (NWS 5/13/14; NWS 5/22/14; NWS 6/10/14);
    - **Reservoir storage for the South Platte River is 113% of average (NWS 6/10/14);**
    - Streamflow forecasts in the South Platte Basin range from 90% of average to about 130% of average through July, possibly up to 150% in some locations. (USDA 6/14/14)
    - **The Cache la Poudre River at Greeley is below action stage and is expected to remain below flood stages (NWS/MOTF 6/19/14)**
    - **This is the last FEMA MOTF situation report. (MOTF 6/19/14)**
    - The State Coordinating Officer's (SCO) primary concern is debris dam flooding relative to the upcoming snow melt/runoff; the State will deploy weather spotters as necessary for specific hydrology or weather threats. (CO-FEMA TTX 4/18/14)

- **Some rainfall is possible through the weekend with near average temperatures. Most mountain snowpack has melted off, though some sites will continue melting and influencing river stages. (NWS/MOTF 6/26/14)**

- Due to September 2013's rain and flooding, the risk of flooding and flash flooding is higher in 2014 primarily in the Front Range Foothills extending into the urban corridor in Boulder, Larimer, SW Weld and extreme northern Jefferson Counties (NWS 5/28/14):
    - Altered locations/conditions of streams may impact structures/infrastructures at risk;
    - Some reservoirs in these areas are at or near capacity and will spill earlier than usual, causing additional flow during runoff and thunderstorm season;
    - Debris flows and landslides may cause access issues and creek obstruction.

10. MOTF Impact Assessments:

- Parcel and valuation exposures for the 100-year Flood Recovery Mapping floodplain were vetted by the State of Colorado, FEMA MOTF, and FEMA Region VIII. The exposure estimates are mapped and publically available on the MOTF GeoPlatform site.

- MOTF conducted brief field work in Greeley on Wednesday, June 4, in response to the minor flooding occurring along the Cache la Poudre River. GPS-based high water marks (HWM) were recorded in some areas, and a flood inundation assessment is pending additional data collection once river flows decrease and high water recedes enough to conduct physical investigation. Impact assessments will be based on observed due to the low number of structures exposed to flooding; however, data collected will be made available on the MOTF geoplatform site linked

above.

- MOTF is reviewing recent NWS streamflow forecasts to determine inundation mapping methods for additional exposure estimates. These analyses are pending coordination with partners.

11. Significant Updates Since Last Report:

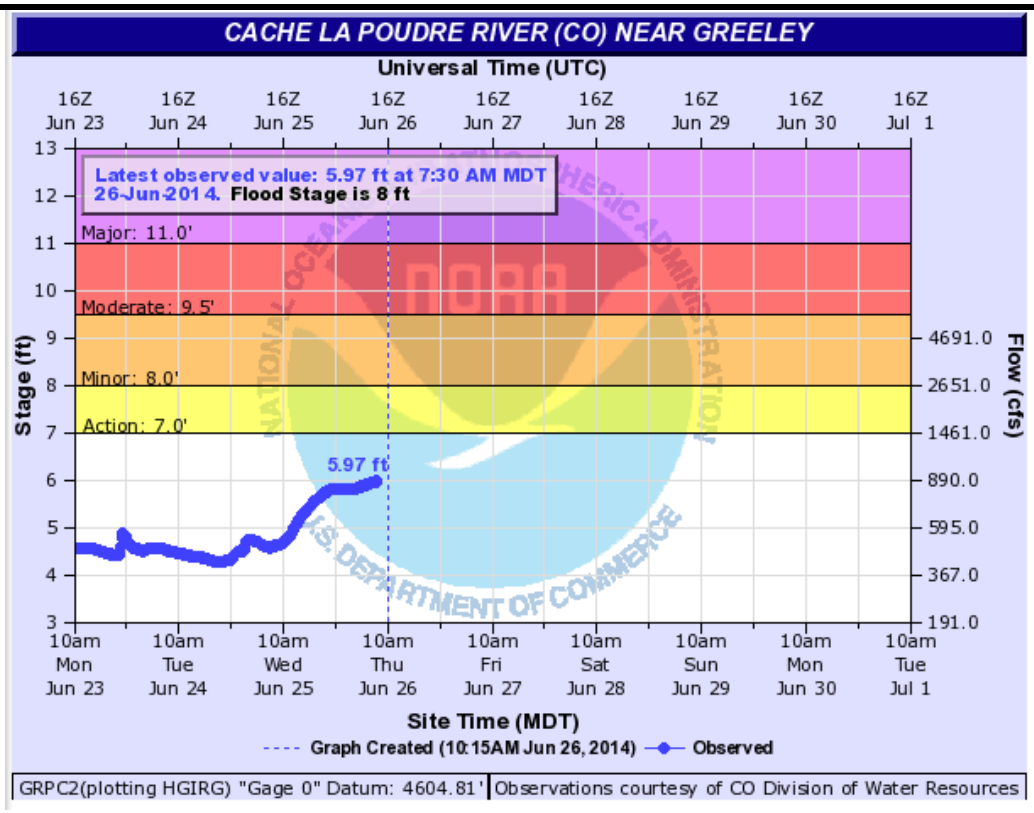
- Seasonal snowmelt flood risk is diminishing. Weather conditions are near seasonal normals.
- MOTF continues coordinating with NWS, Boulder County, FEMA NDRF, and DR-4145-CO JFO staff concerning debris-related hydrology issues potentially influencing spring flood risk. The joint state-federal situation cell continues to produce coordinated risk information on behalf of planning, external affairs/public information officers, and GIS/modeling support.

12. Other Federal Agency and State Coordination:

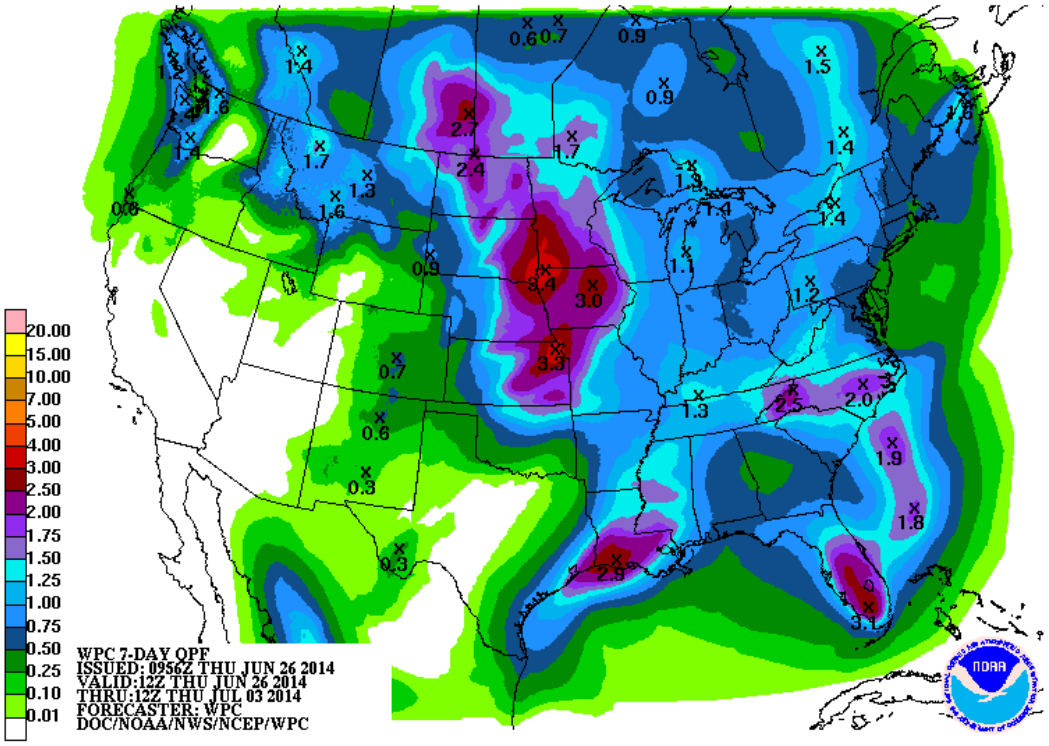
- **Ongoing coordination with the National Weather Service;**
- Ongoing coordination with Colorado Governor's Office and Office of Information Technology;
- Ongoing coordination with Colorado Division of Homeland Security and Emergency Management (DHSEM);
- Ongoing coordination with the Colorado Office of Emergency Management (CO OEM);
- Ongoing coordination with the Colorado Department of Public Safety (CDPS);
- Ongoing coordination with State of Colorado GIS Coordination Group;
- Ongoing coordination with the Colorado Governor's Flood Task Force;
- Ongoing coordination with City of Boulder GIS and Boulder County GIS;
- Ongoing coordination with Colorado Department of Local Affairs for local jurisdictions;
- Ongoing coordination and resource assignments with USDA-NRCS and USACE;
- Ongoing coordination and readiness assessment with USGS-Colorado Water Science Center for temporary stream gage placement and monitoring in high risk debris areas;
- Ongoing coordination and cooperation with the FEMA DR-4145-CO Joint Field Office and NDRF.

13. Significant Impacting Weather:

The NWS Flood Advisory for the Cache la Poudre River at Greeley has been cancelled. The river has fallen below action and flood stages and is expected to remain below these stages. Most mountain snowpack has melted off at this point, and river stages should generally come down in coming weeks. **Some thunderstorms are possible with brief heavy rain from Friday and after Wednesday. Significant flooding or other impactful weather is not expected in Colorado.**



http://water.weather.gov/ahps2/hydrograph.php?wfo=bou&gage=grpc2



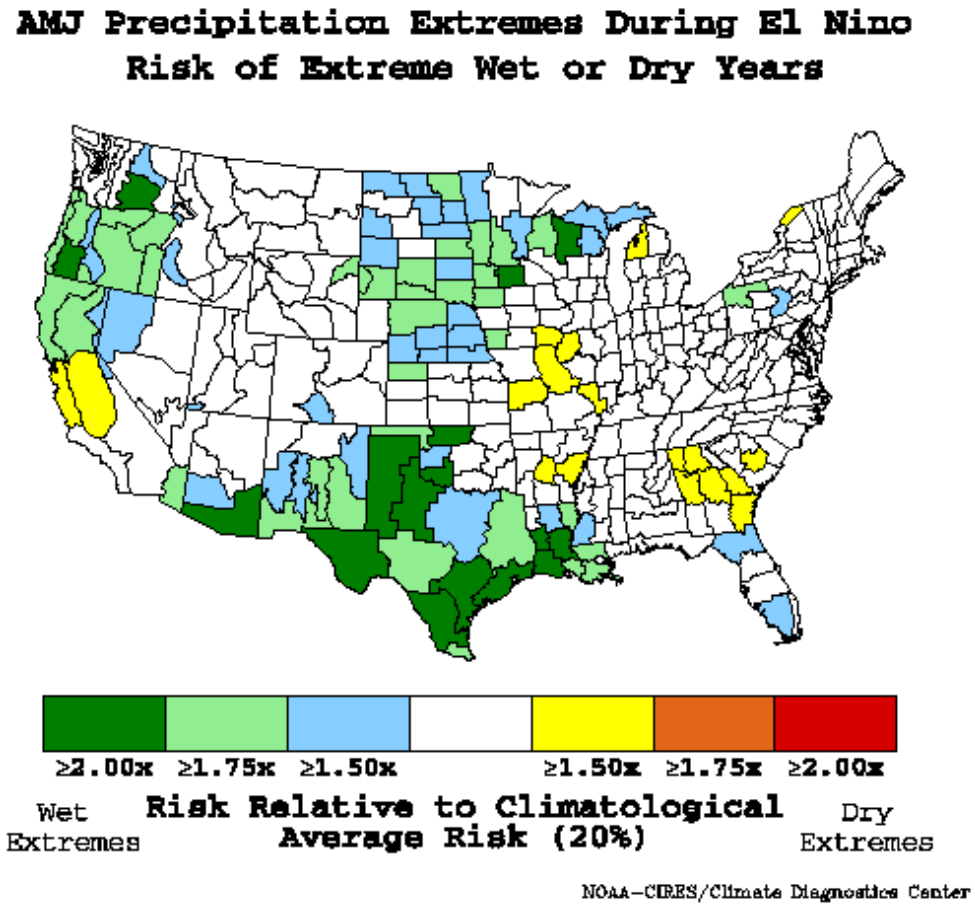
*National Weather Service (valid through July 3, 2014)

14. Other Notes, Issues, or Additional Remarks (SEE ATTACHED MAPS/STATS):

USDA NRCS SNOTEL and streamflow forecasts represent 50 percent change of exceedance, meaning there is a 50 percent chance that actual streamflow volumes will exceed specific forecast values, and there is a 50 percent chance that actual streamflow volumes will be less than this forecast value.

Historical flood crests on the South Platte River and Cache la Poudre River occurred in 1965 and 1973. **There is a 10 percent probability of exceeding historical crests in some locations along these rivers based on snowmelt and other environmental variables**; however, the floods of 1965 and 1973 were tied specifically to heavy rainfall. A significant success story during the 1973 flooding in Denver focused on clearing flood debris at bridges which limited debris damming and subsequent overflow inundation. (NWS; CSU; NCAR)

Risk of extreme precipitation during El Niño years for the months of April, May, and June is not significantly different in the Colorado Front Range compared to long-term climatological risk:



**NOAA ESRL Physical Sciences Division* & *University of Colorado at Boulder-CIRES*

15. Proposed Objectives for Next Operational Period:

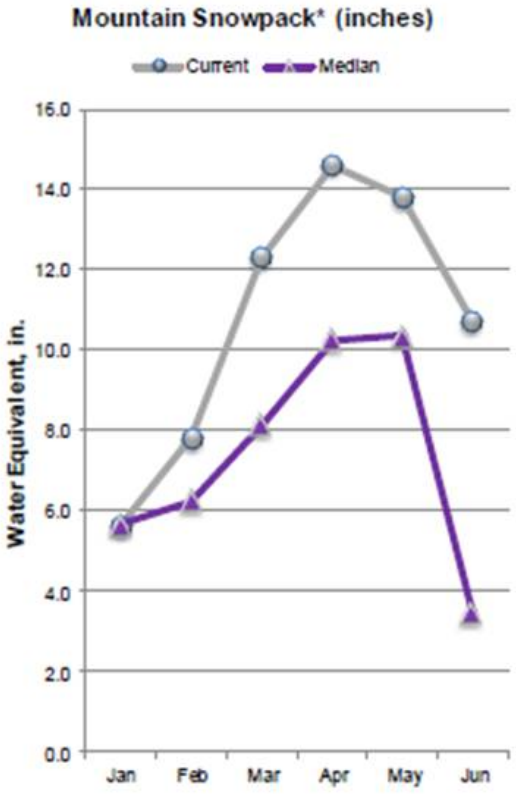
1. Although this is the final MOTF Colorado Spring Flooding 2014 Situation Report, the MOTF will continue to monitor the weather in Colorado for situational awareness and possible flash flooding.

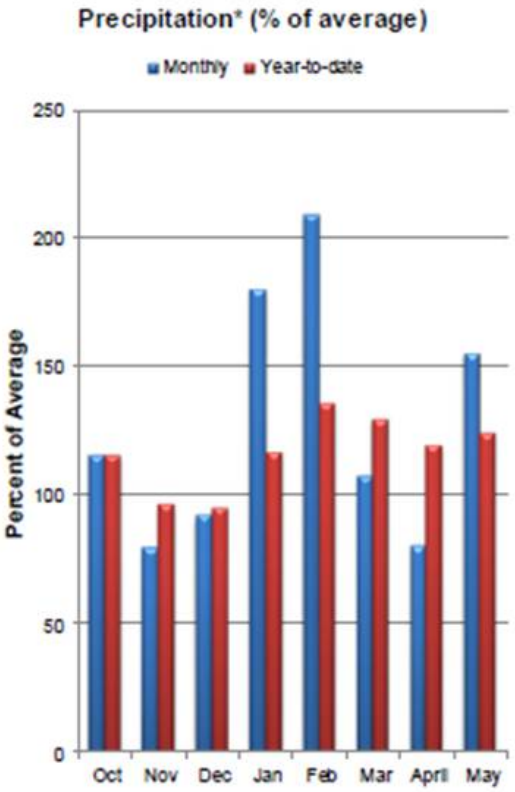
16. Next Update Expected: ***This is the final report***

17. Prepared by:	**18. Reviewed by:**
Casey Zuzak, MOTF Risk Analyst Region VIII Risk Analyst	Jesse Rozelle, MOTF Team Lead Region VIII Geospatial Coordinator/Risk Analyst

MOTF: SPECIAL FOCUS ON SOUTH PLATTE RIVER BASIN:

According to the USDA Natural Resources Conservation Service and SNOTEL data, the South Platte River currently contains the highest snowpack at about 311 percent of median as of June 1, with only about 56% of the total 2014 snowpack remaining: "According to SNOTEL sites in the basin, the snowpack in the South Platte basin peaked at 131 percent of the normal peak this season." May precipitation was above average in the Saint Vrain Basin. The snowpack snow-water-equivalent graph below is for the South Platte River Basin only, revealing about 11 inches of water stored in the snowpack on June 1:

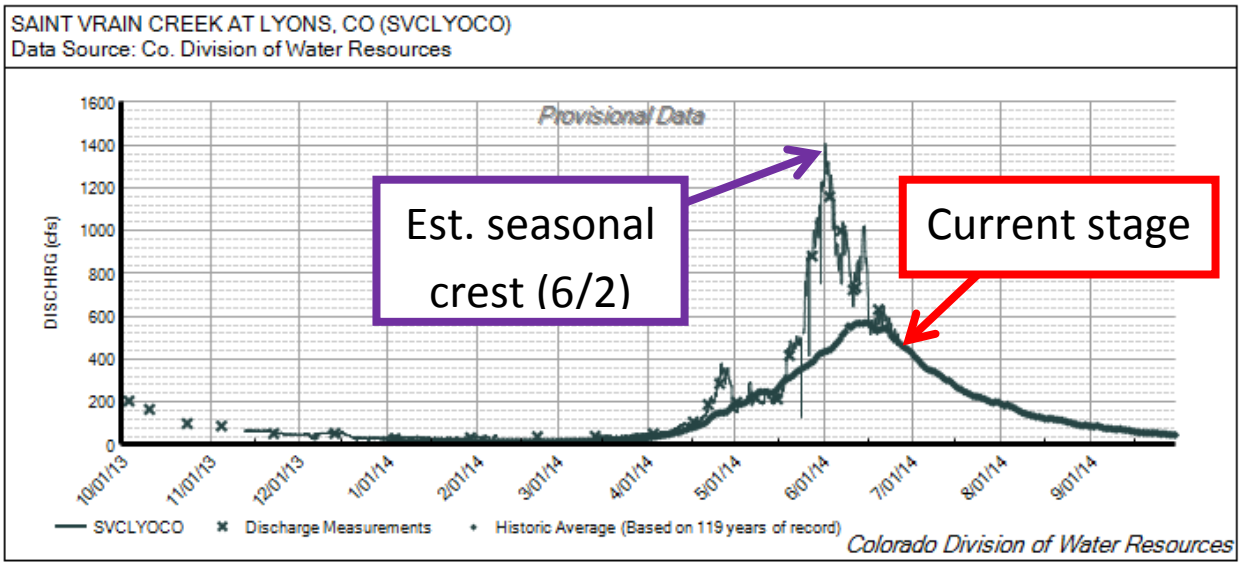




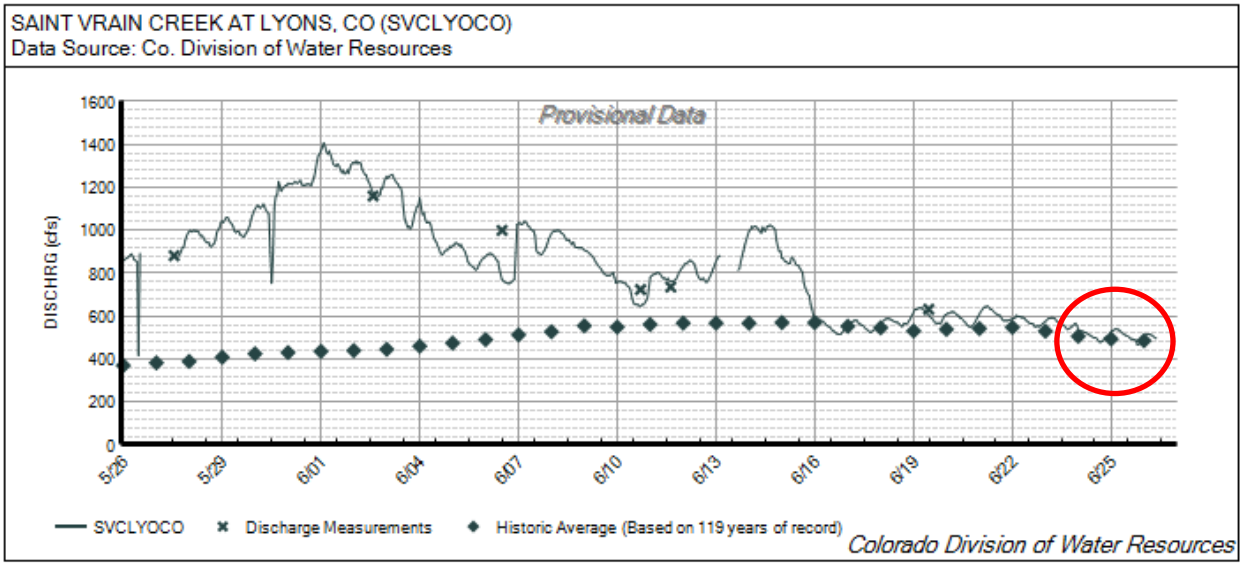
Per NWS Streamflow Forecast Update issued on May 15, 2014 for the South Platte River Basin, most streams/rivers/creeks are expected to see flows at approximately 112% of average through July 2014, representing a decrease in forecast flows by about 13% since the previous April 24 forecast:

STREAM	STATION	PERIOD	FORECAST % AVG - APRIL 24	FORECAST % AVG - MAY 15	DIFFERENCE
SOUTH PLATTE RIVER	ANTERO RESERVOIR INFLOW	MAY-JULY	120	111	-9%
	SPINNEY MTN RES INFLOW	MAY-JULY	125	116	-9%
	11-MILE CANYON RES INFLOW	MAY-JULY	124	116	-8%
	CHEESMAN LAKE INFLOW	MAY-JULY	126	110	-16%
	SOUTH PLATTE	MAY-JULY	125	107	-18%
BEAR CREEK	EVERGREEN ABV	MAY-JULY	119	90	-29%
	MORRISON	MAY-JULY	118	--	--
CLEAR CREEK	GOLDEN	MAY-JULY	130	118	-12%
ST VRAIN CREEK	LYONS	MAY-JULY	125	109	-16%
BOULDER CREEK	ORODELL	MAY-JULY	128	118	-10%
SOUTH BOULDER CREEK	ELDORADO SPRINGS	MAY-JULY	126	117	-9%
BIG THOMPSON RIVER	CANYON MOUTH	MAY-JULY	128	115	-13%
CACHE LA POUDRE	CANYON MOUTH	MAY-JULY	129	119	-10%

Streamflow on the St. Vrain Creek at Lyons, Colorado indicates that runoff appears to have peaked on or about June 2, with flows since then decreasing significantly. NWS flow forecasts for this location have been exceeded due to warmer than average temperatures and thunderstorm rainfall, with current flow at about 490 cfs (CO DWR 6/26/14). Further decreases in flow are expected:

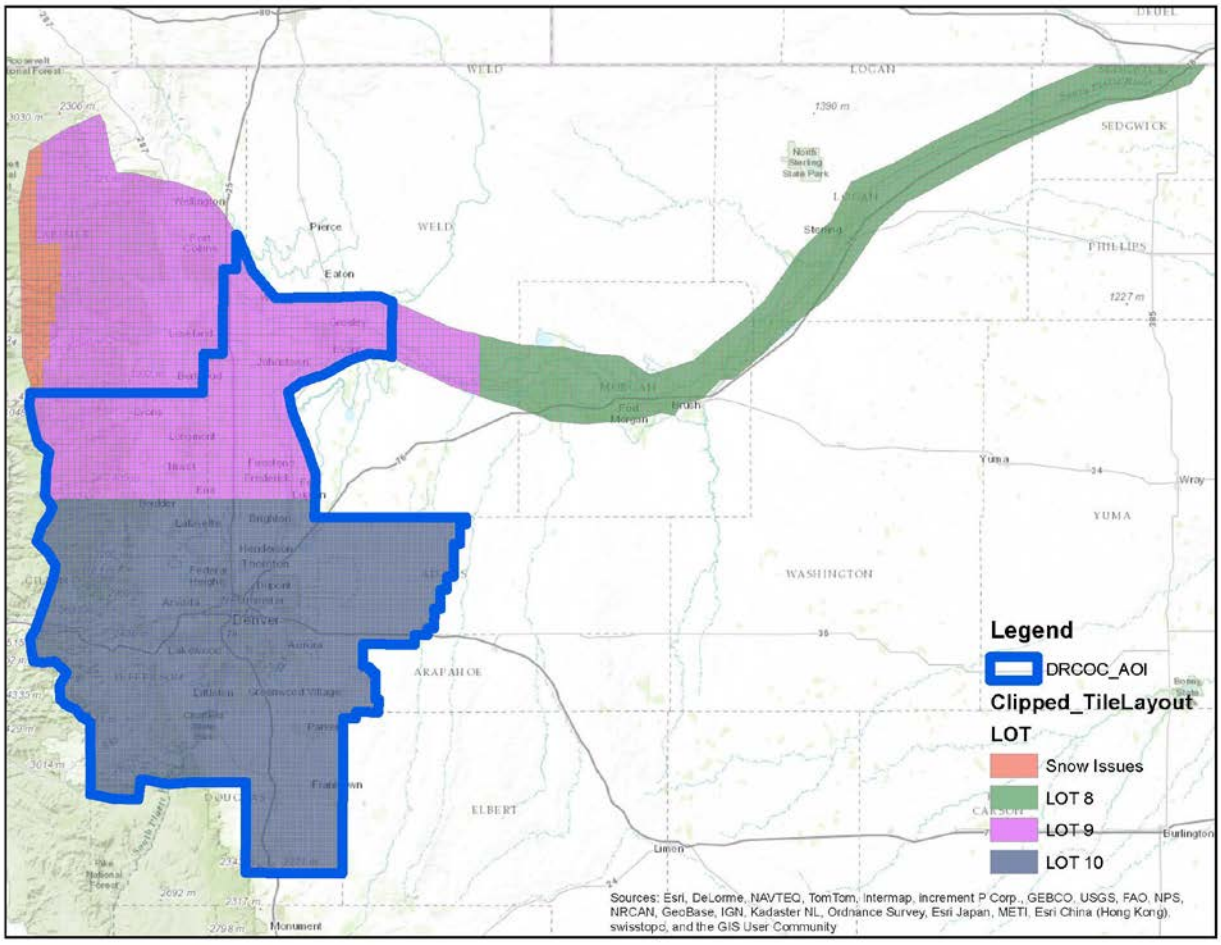


Within the past 7 days the streamflow on the St. Vrain Creek at Lyons lowered to near seasonal averages, with a seasonal crest near 1,400 cfs on June 2. Near average flows are expected over the next week with rainfall, runoff, and near average temperatures; however, flows are expected to continue falling as snow cover diminishes:

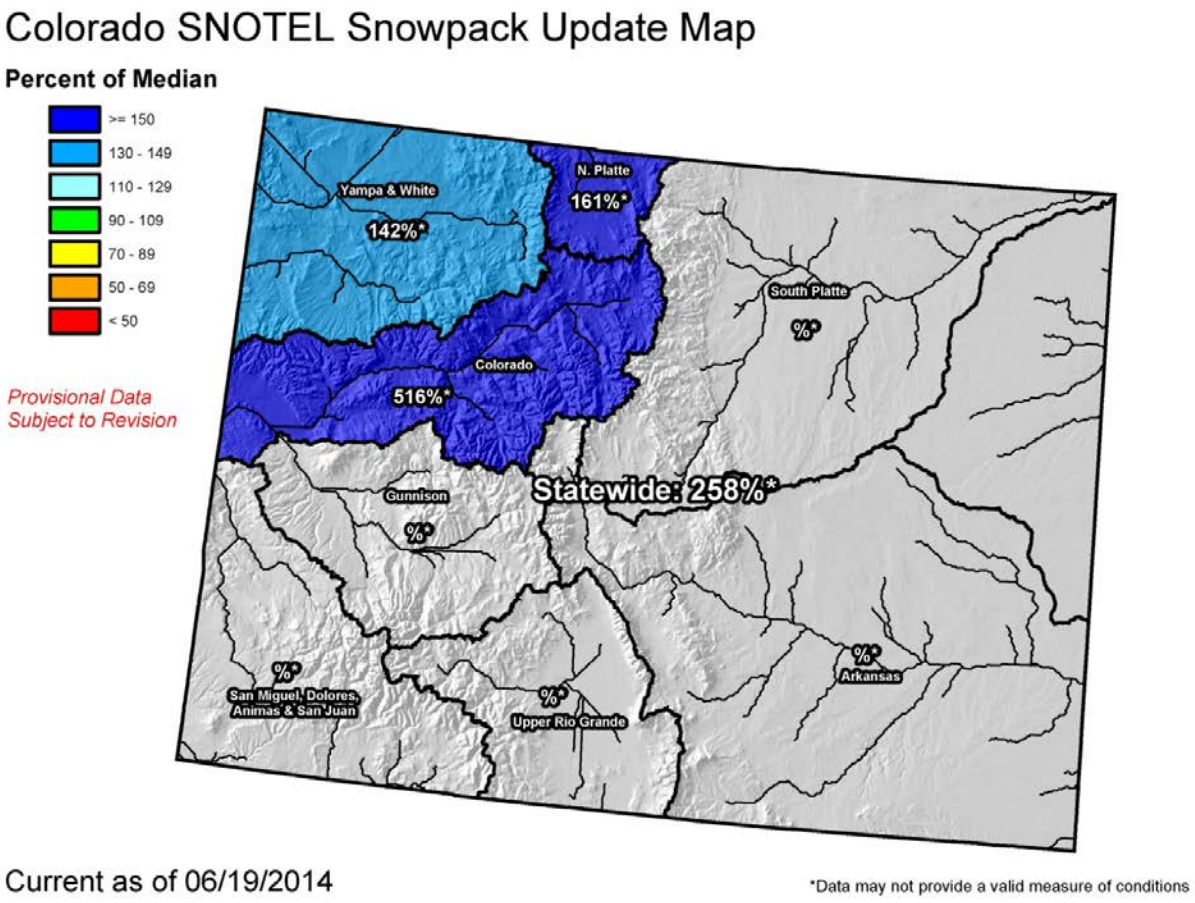


http://www.dwr.state.co.us/SurfaceWater/data/detail_graph.aspx?ID=SVCLYOCO&MTYPE=DISCHRG

LIDAR COVERAGE MAP DESIGNATED BY "LOT" NUMBERS:

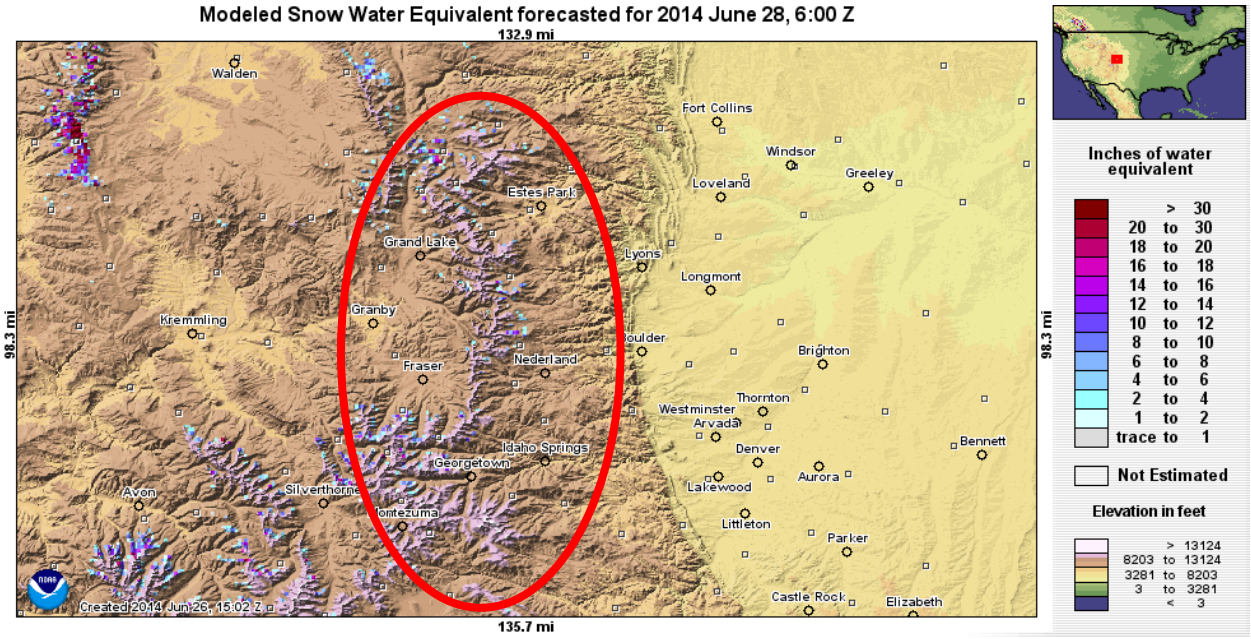


CURRENT STATEWIDE SNOWPACK AS OF JUNE 19, 2014:



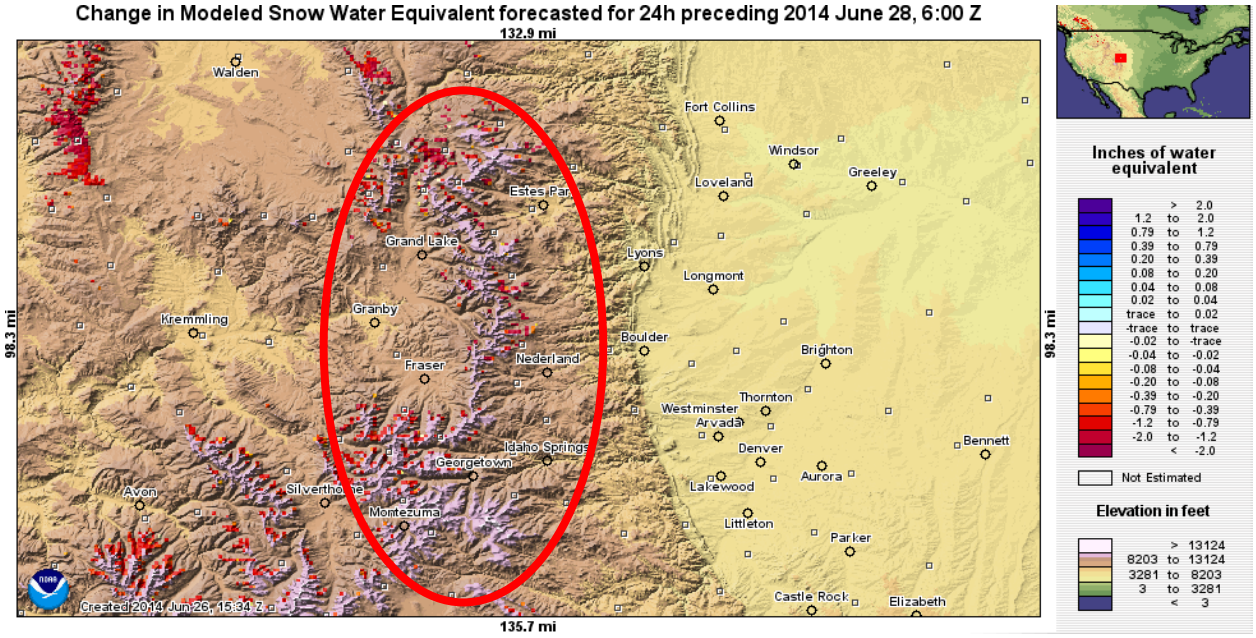
Map prepared by the USDA Natural Resources Conservation Service Snow Survey:
ftp://ftp-fc.sc.egov.usda.gov/CO/Snow/snow/watershed/daily/co_update_snow.pdf

CURRENT ZOOM SNOW-WATER EQUIVALENT ESTIMATE FROM NOAA NOHRSC:

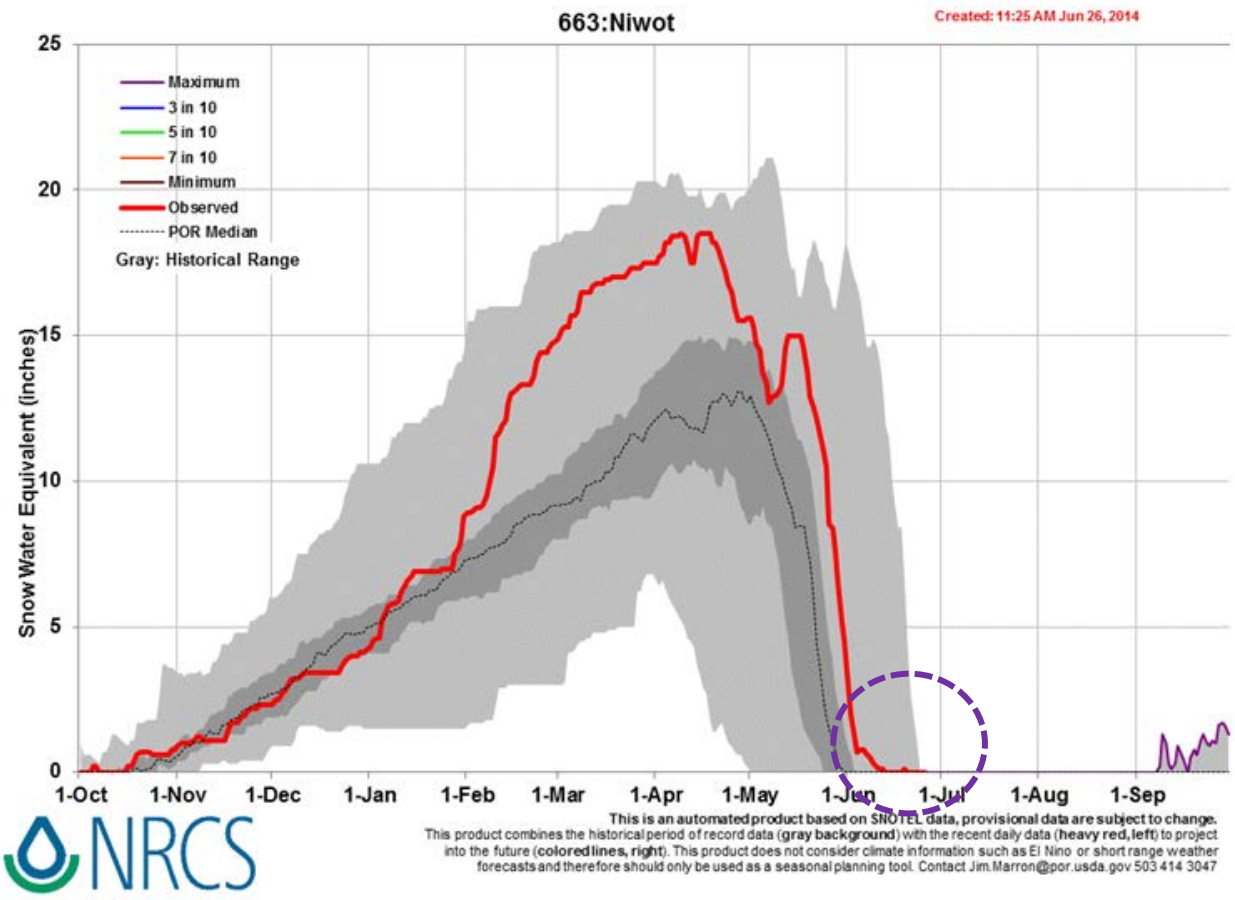


This zoomed image of the remaining snowpack in the Colorado Front Range reveals that there is up to about 15 inches of isolated snow-water equivalent in some high elevation areas. Overall, SWE is decreasing rapidly due to warm temperatures and generally seasonal change.

CURRENT ZOOM SNOW-WATER EQUIVALENT CHANGE FROM NOAA NOHRSC:



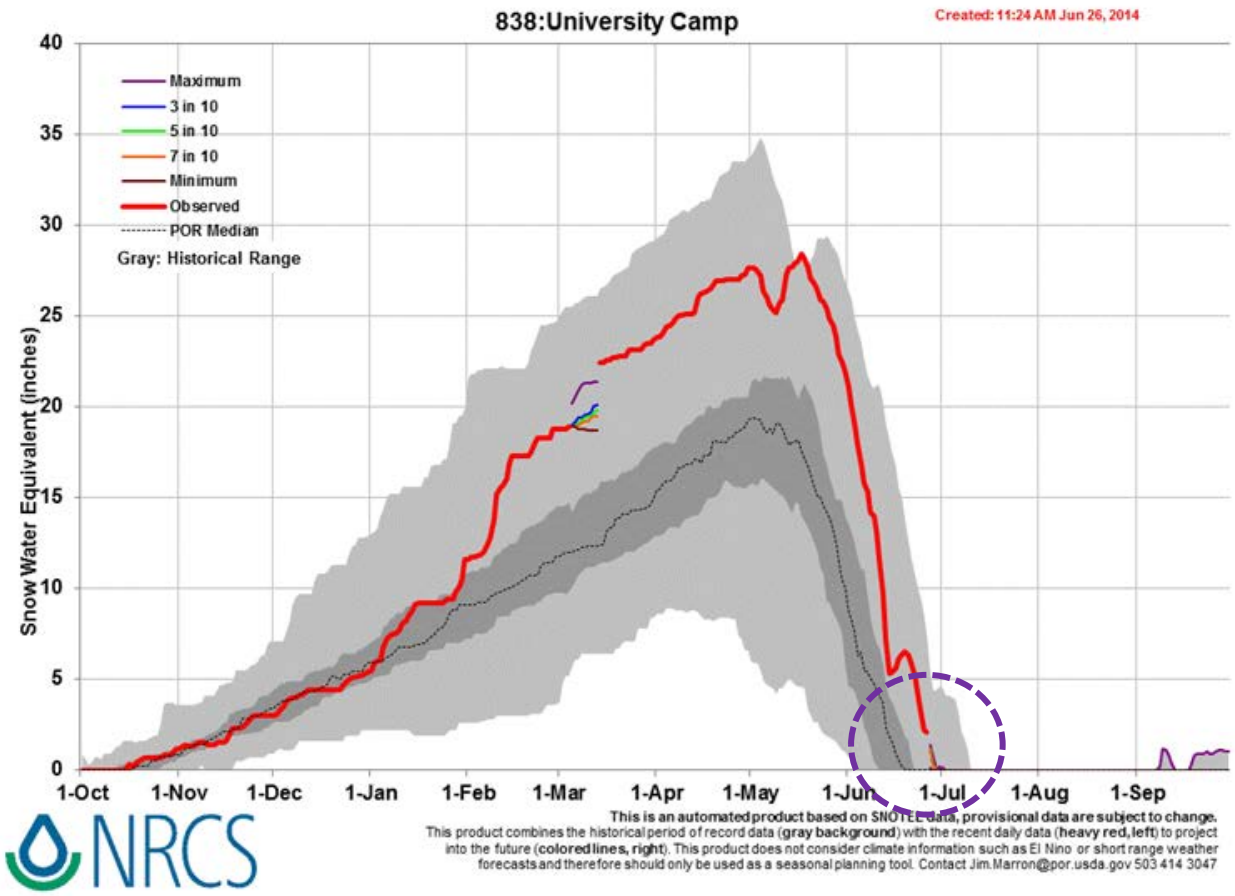
CURRENT SNOW-WATER EQUIVALENT ESTIMATE FOR NIWOT SNOTEL SITE FROM USDA-NRCS AS OF JUNE 26, 2014:



Current Snow-Water Equivalent (SWE) measurement at the Niwot SNOTEL Site indicates that seasonal snowmelt has concluded with the dissolution of snow cover. This site is reflective of many in the Front Range, where seasonal snowmelt is ending. **The dissolution of the snowpack means less total runoff affecting Front Range streams. This trend will continue at sites where snowcover is evaporating or melting off as the seasons change.** Other sites can be reviewed online:

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrcs144p2_063315

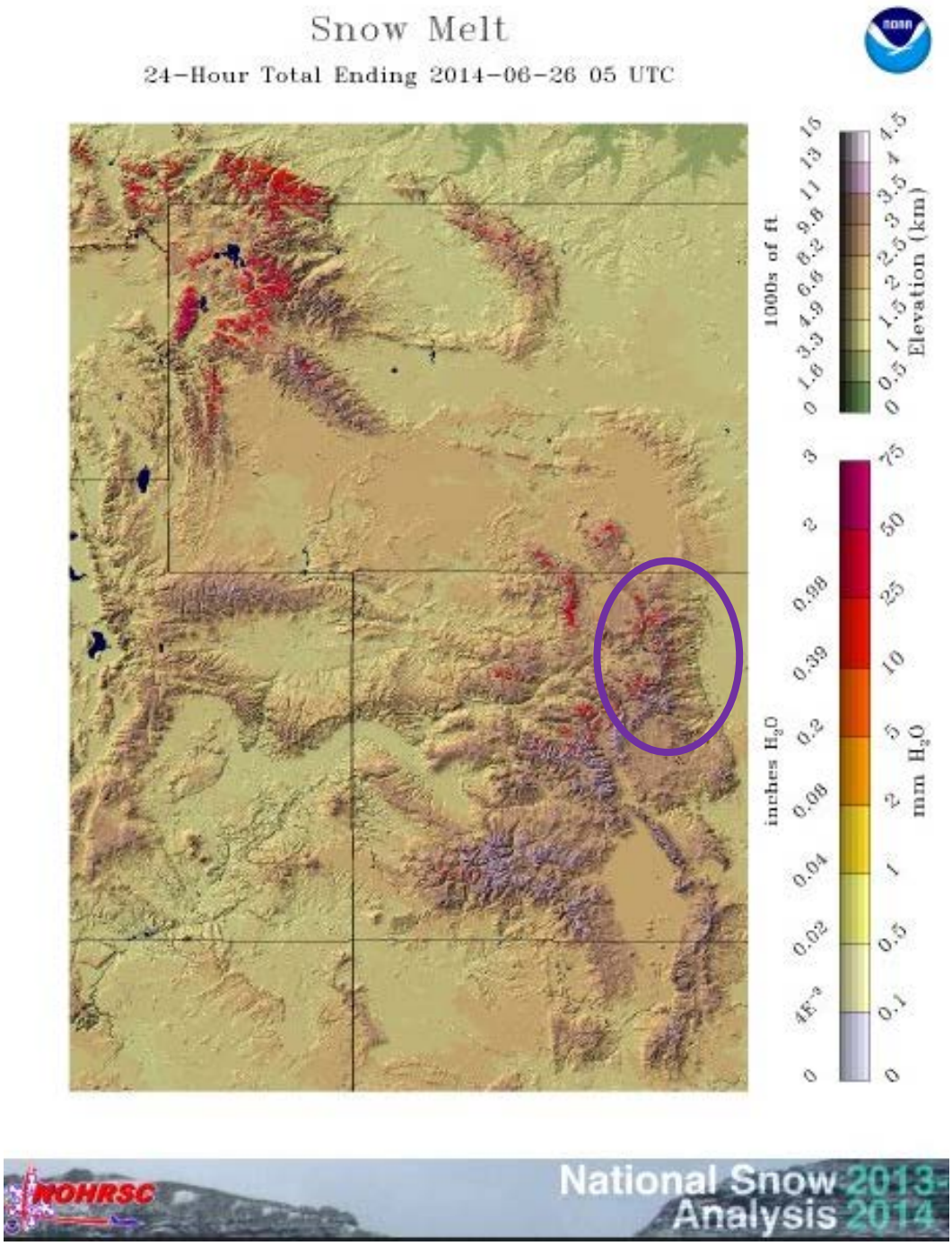
CURRENT SNOW-WATER EQUIVALENT ESTIMATE FOR UNIVERSITY CAMP SNOTEL SITE FROM USDA-NRCS AS OF JUNE 26, 2014:



Current Snow-Water Equivalent (SWE) measurement at the University Camp SNOTEL Site indicates about 2 inches of SWE remain as of June 26, or about a 25" decrease since peaking near May 22. Overall, SWE at this location is below historical maxima, and indicates that snowmelt runoff in downstream locations will continue through late June. Total SWE appears to have increased at this site in recent days, and is evident of increased sublimation (phase change from frozen water directly to water vapor without a liquid state). The snowpack here will likely decrease in snow depth while increasing in SWE until the snow is mostly liquid and rapidly melts or evaporates. The FEMA MOTF selected the University Camp SNOTEL Site to demonstrate the remaining snowpack SWE and snowmelt runoff changes influencing the South Platte River drainage basin, particularly the Cache la Poudre drainage basin—**this is the only remain SNOTEL instrumentation site with more than one (1) inch of SWE remaining**. Other sites can be reviewed online:

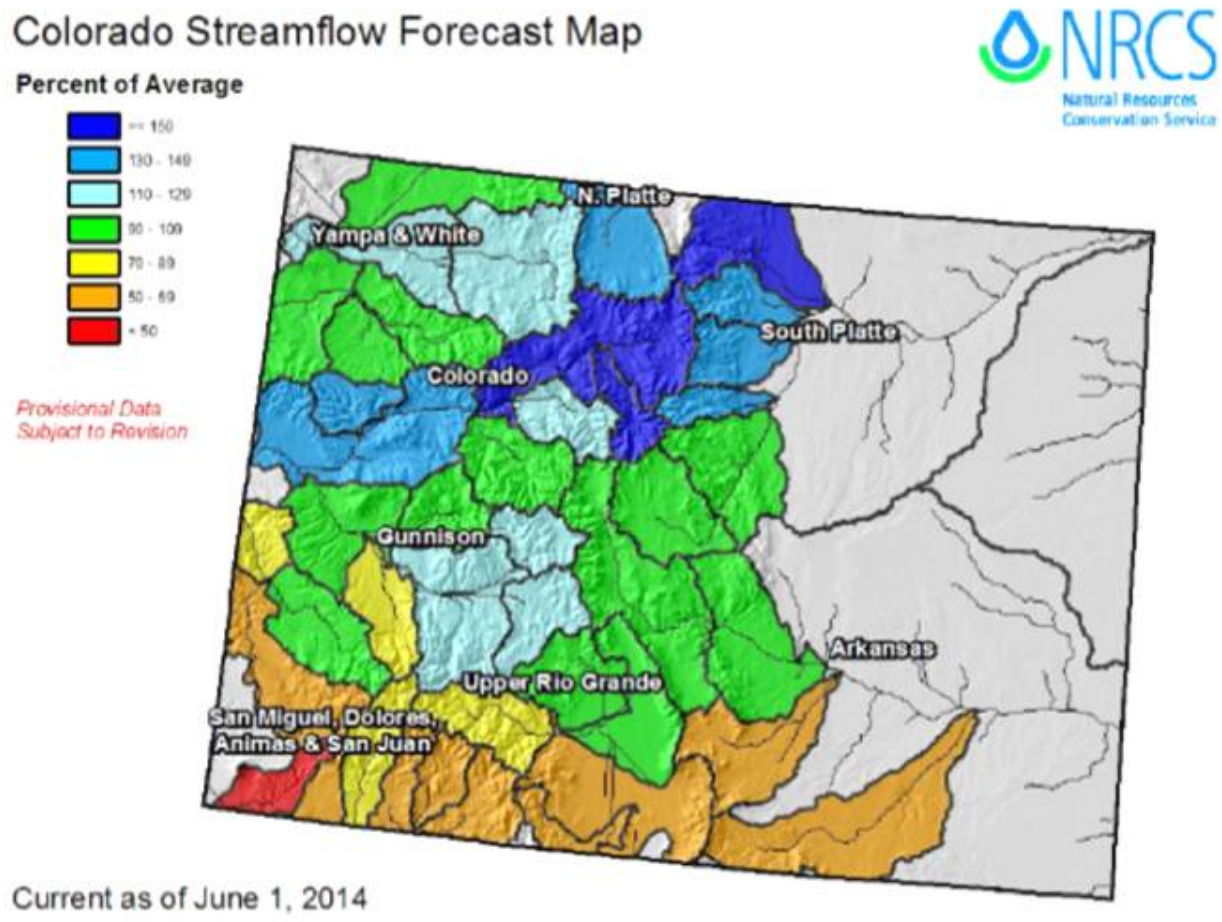
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrcs144p2_063315

CURRENT SNOWMELT RATE MODELING FROM NOAA NOHRSC:



Two-week snowmelt change detection:
http://www.nohrsc.noaa.gov/nsa/js_animate.html?year=2014&month=4&day=24&type=nsm_melt&region=Central_Rockies

USDA NRCS FORECAST STREAMFLOW FOR JUNE-TO-JULY 2014 (JUNE 1):



The USDA released its "Colorado Water Supply Outlook Report" on June 14, which included the streamflow forecast map above. Generally, the above-average snowpack portends above average streamflow for the June through July timeframe. Streamflows in the South Platte Basin should be between 90 and 149 percent of average during this period, although some smaller drainages in the Denver area should be near average (90-109% of average). Higher than average streamflows represent increased runoff flows from snowmelt and potential thunderstorms.