Draft Presentation (minor edits possible prior to meeting)

Groundwater Sustainability Plan for Big Valley Groundwater Basin

Lassen and Modoc Counties

Advisory Committee Meeting 6

November 4, 2020

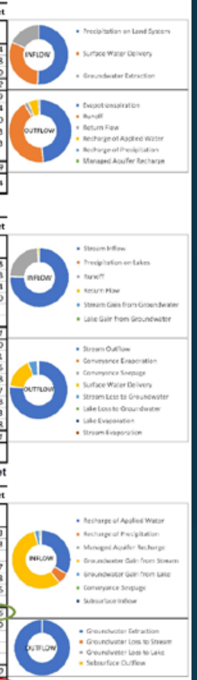
#	Flow Type	Origin/ Destination	Component	LAND SYSTEM Acre-Feet
(1)	Inflow	Into Basin	Precipitation on Land System	135,134
(2)	Inflow	Between Systems	Surface Water Delivery	83,368
(3)	Inflow	Between Systems	Groundwater Extraction	47,590
(4)	Inflow	(1)+(2)+(3)	*Total Inflow*	*266,092*
(5)	Outflow	Out of Basin	Evapotranspiration	128,739
(6)	Outflow	Between Systems	Runoff	114,864
(7)	Outflow	Between Systems	Return Flow	5,800
(8)	Outflow	Between Systems	Recharge of Applied Water	13,923
(9)	Outflow	Between Systems	Recharge of Precipitation	2,703
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-
(11)	Outflow	(5)+(6)+(7)+(8)+(9)+(10)	*Total Outflow*	*266,029*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	64

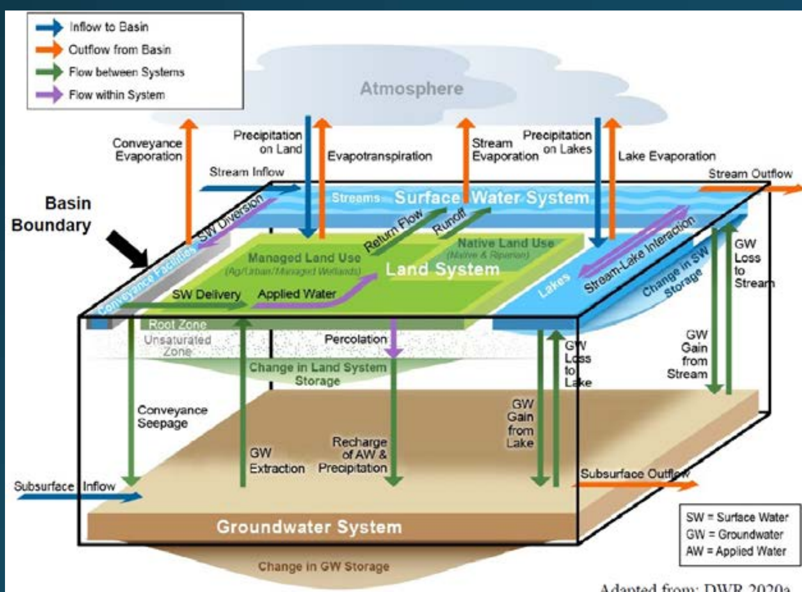
Figure 6-5 Average Annual Land System Water Budget

#	Flow Type	Origin/ Destination	Component	SURFACE WATER SYSTEM Acre-Feet
(13)	Inflow	Into Basin	Stream Inflow	371,148
(14)	Inflow	Into Basin	Precipitation on Lakes	998
(6)	Inflow	Between Systems	Runoff	114,864
(7)	Inflow	Between Systems	Return Flow	5,800
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-
(17)	Inflow	(13)+(14)+(6)+(7)+(15)+(16)	*Total Inflow*	*492,811*
(18)	Outflow	Out of Basin	Stream Outflow	375,320
(19)	Outflow	Out of Basin	Conveyance Evaporation	821
(20)	Outflow	Between Systems	Conveyance Seepage	446
(2)	Outflow	Between Systems	Surface Water Delivery	83,368
(21)	Outflow	Between Systems	Stream Loss to Groundwater	24,037
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,553
(24)	Outflow	Out of Basin	Stream Evaporation	2,128
(25)	Outflow	(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)	*Total Outflow*	*492,811*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-

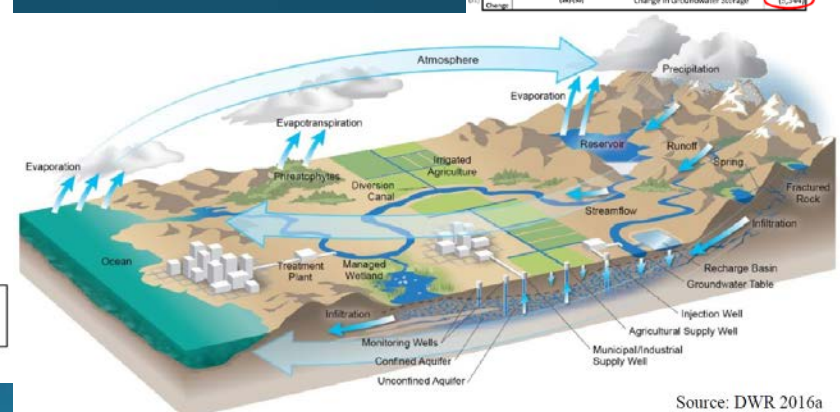
Figure 6-6 Average Annual Surface Water System Water Budget

#	Flow Type	Origin/ Destination	Component	GROUNDWATER SYSTEM Acre-Feet
(8)	Inflow	Between Systems	Recharge of Applied Water	13,923
(9)	Inflow	Between Systems	Recharge of Precipitation	2,703
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	24,037
(22)	Inflow	Between Systems	Groundwater Gain from Lake	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446
(27)	Inflow	Into Basin	Subsurface Inflow	-
(28)	Inflow	(8)+(9)+(10)+(21)+(22)+(20)+(27)	*Total Inflow*	*42,246*
(3)	Outflow	Between Systems	Groundwater Extraction	47,590
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(30)	Outflow	(3)+(15)+(16)+(29)	*Total Outflow*	*47,590*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(5,344)





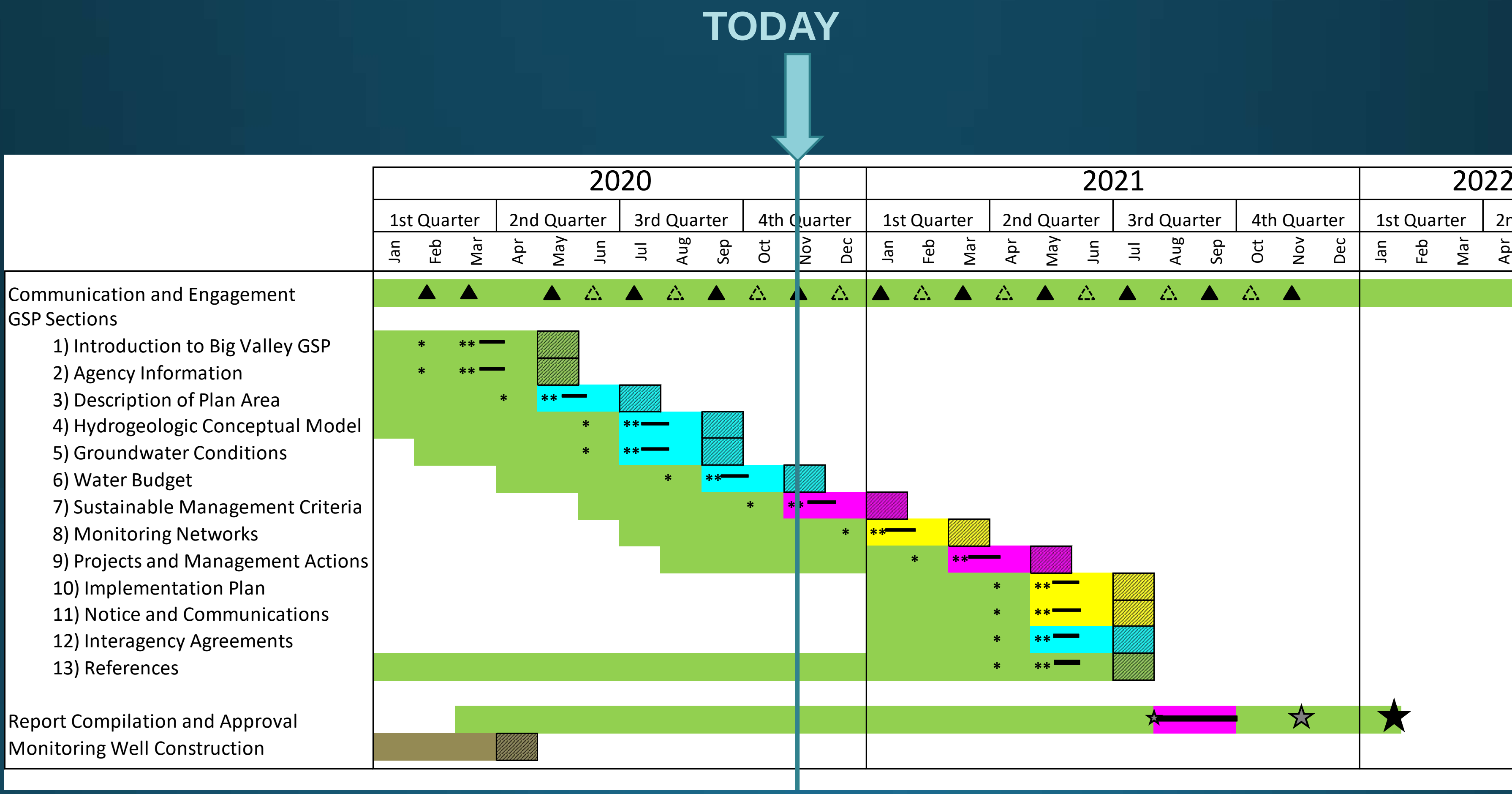
Adapted from: DWR 2020a



Source: DWR 2016a

GENERAL UPDATES AND SCHEDULE

GSP DEVELOPMENT SCHEDULE



GSP CHAPTERS

TODAY →

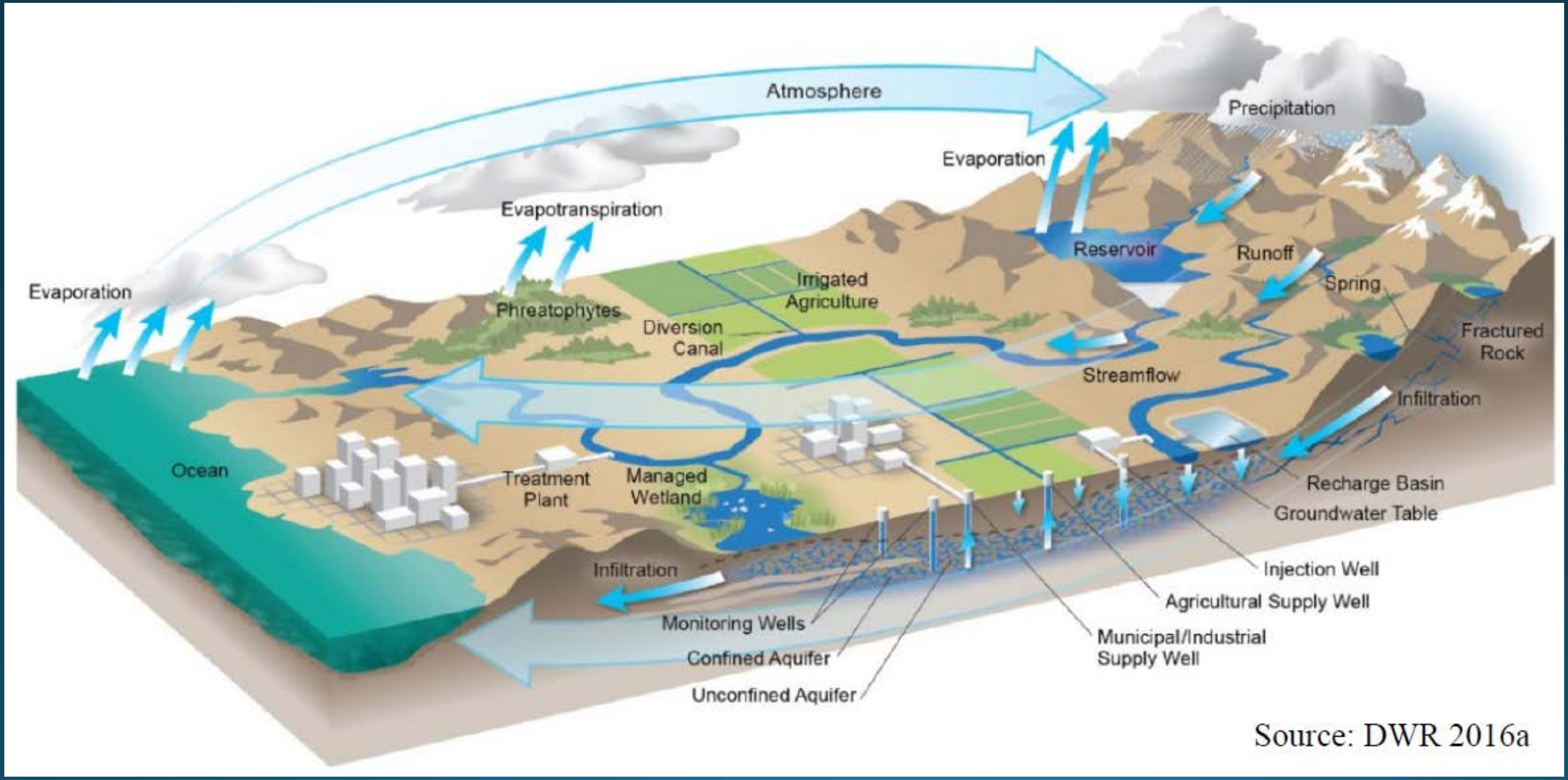
Chapters	Stakeholder input
1 Introduction 2 Agency Information 3 Description of Plan Area	**Stakeholder input: LOW**. Background and foundational information. Mostly provided by consultant team and GSA staff. Just need to meet the regulations.
4 Hydrogeologic Conceptual Model 5 Groundwater Conditions 6 Water Budget	**Stakeholder input: LOW.** Foundational and structural information based on best available data and science. Must be signed by a Professional Geologist.
7 Sustainable Management Criteria 8 Monitoring Networks 9 Projects and Management Actions	**Stakeholder input: HIGH.** Decision-making chapter. Establishes the monitoring, thresholds and management actions that stakeholders will have to adhere to.
10 Implementation Plan 11 Notice and Communications 12 Interagency Agreements	**Stakeholder input: MODERATE.** Describes how the decisions made in Ch 7-9 will be implemented and how stakeholders will continue to be informed and participate.
13 Reference List	**Stakeholder input: LOW.** Just need to meet the regulations.

AGENDA

- Subject #1
  - Chapter 6 – Water Budget
- Subject #2:
  - Chapter 5 – Groundwater Conditions
- Subject #3
  - New Stream Gage(s)

SUBJECT #1: CH 6 WATER BUDGET

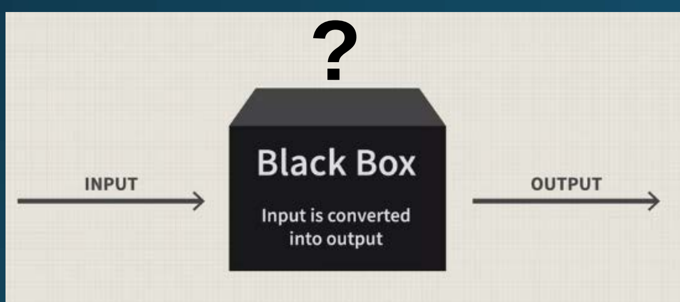
Hydrologic Cycle

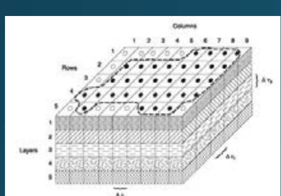


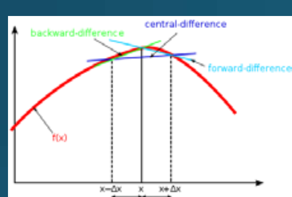
SUBJECT #1: CH 6 WATER BUDGET – APPROACHES TO MODELING

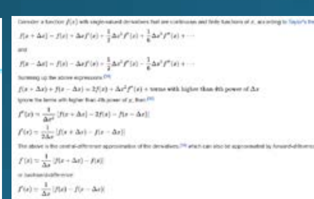
- Numerical Model
  - Specialized software
    - MODFLOW
    - IWFM
  - Specially trained professional
  - Higher implementation cost
  - “Black box”

- Spreadsheet Model
  - Uses Excel
  - Accessible to a broader range of professionals
  - More easily modified and adjusted
  - Lower implementation cost
  - Greater transparency









TOTAL BASIN WATER BUDGET — Acre-Feet

Item	Flow Type	Origin/ Destination	Component	
(1)	Inflow	Into Basin	Precipitation on Land System	135,134
(14)	Inflow	Into Basin	Precipitation on Lakes	998
(13)	Inflow	Into Basin	Stream Inflow	371,148
(27)	Inflow	Into Basin	Subsurface Inflow	-
(32)	Inflow	(1)+(14)+(13)+(27)	*Total Inflow*	*507,280*
(5)	Outflow	Out of Basin	Evapotranspiration	128,739
(24)	Outflow	Out of Basin	Stream Evaporation	2,128
(23)	Outflow	Out of Basin	Lake Evaporation	1,553
(19)	Outflow	Out of Basin	Conveyance Evaporation	821
(18)	Outflow	Out of Basin	Stream Outflow	379,320
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	(5)+(24)+(23)+(19)+(18)+(29)	*Total Outflow*	*512,561*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(5,280)

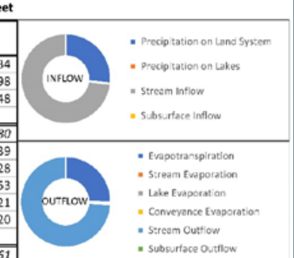
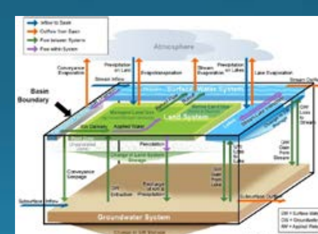
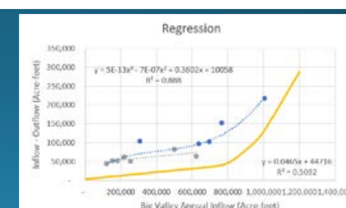


Figure 6-4 Average Annual Total Basin Water Budget

Change in Storage = Inflows – Outflows

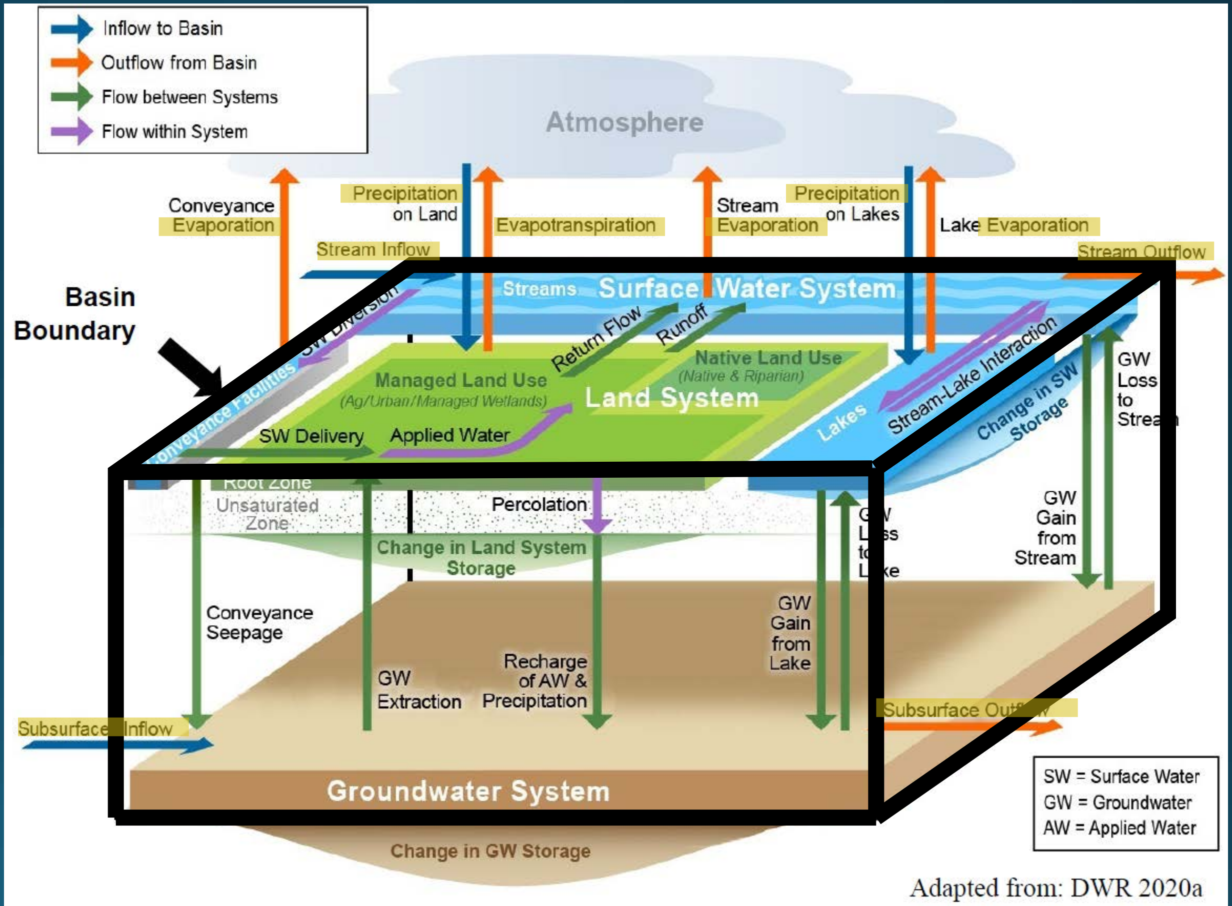




SUBJECT #1: CH 6 WATER BUDGET

Groundwater Basin External Components

- **Stream Inflow/Outflow**
- **Precipitation**
- **Evaporation and Evapotranspiration**
- **Subsurface Inflow/Outflow**



SUBJECT #1: CH 6 WATER BUDGET

Overall Basin

Major Inflows:

- Stream Inflow (73%)
- Precipitation (27%)

Major Outflows:

- Stream Outflow (74%)
- Evapotranspiration (25%)

TOTAL BASIN WATER BUDGET — Acre-Feet

item	Flow Type	Origin/ Destination	Component	
(1)	Inflow	Into Basin	Precipitation on Land System	135,134
(14)	Inflow	Into Basin	Precipitation on Lakes	998
(13)	Inflow	Into Basin	Stream Inflow	371,148
(27)	Inflow	Into Basin	Subsurface Inflow	-
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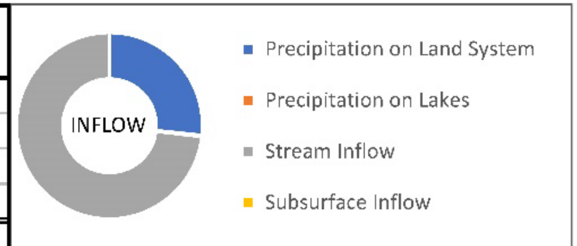


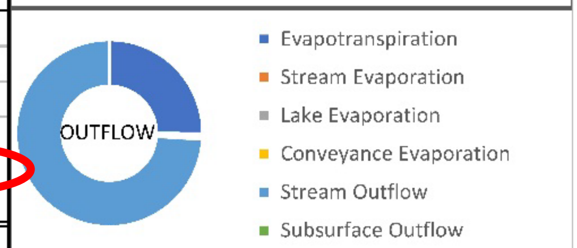
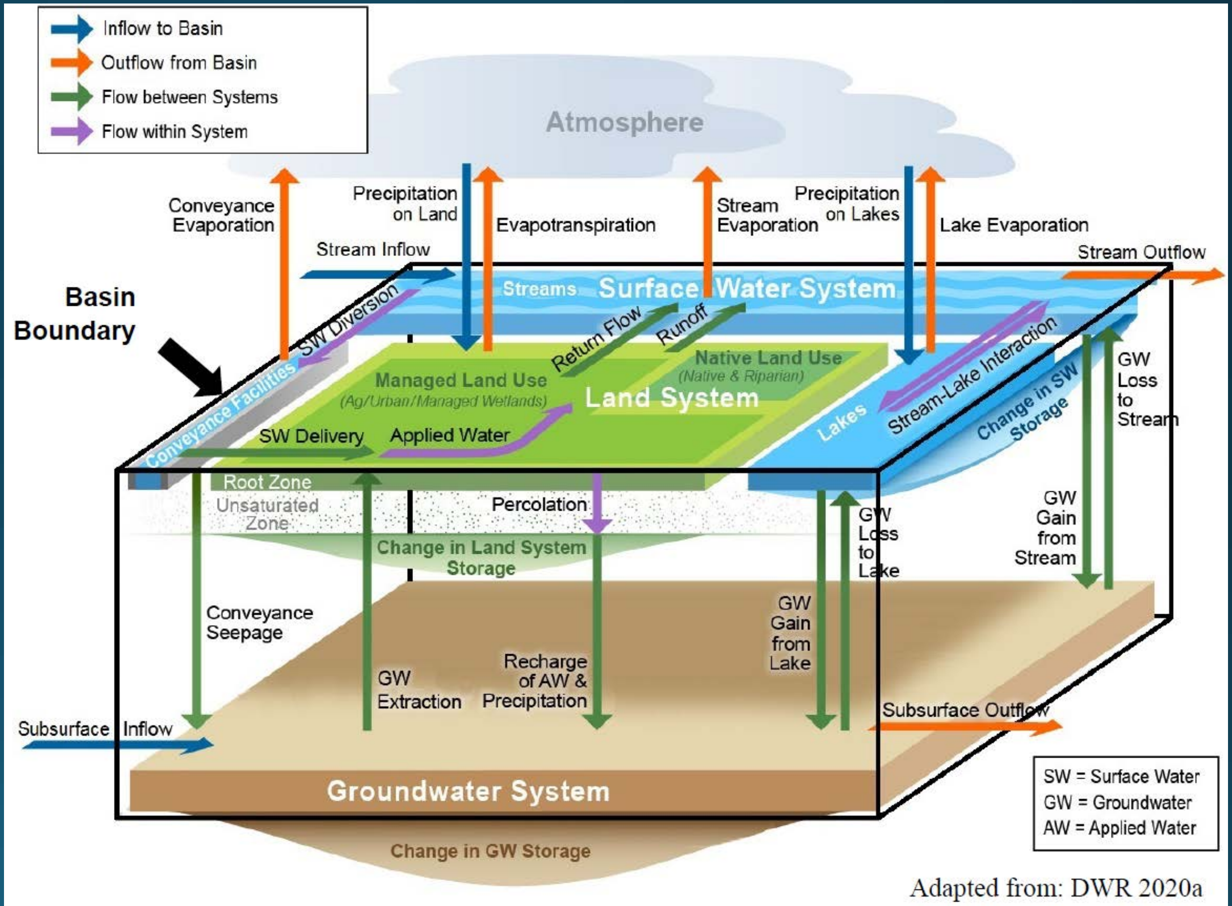


Figure 6-4 Average Annual Total Basin Water Budget

SUBJECT #1: CH 6 WATER BUDGET

Three Systems:

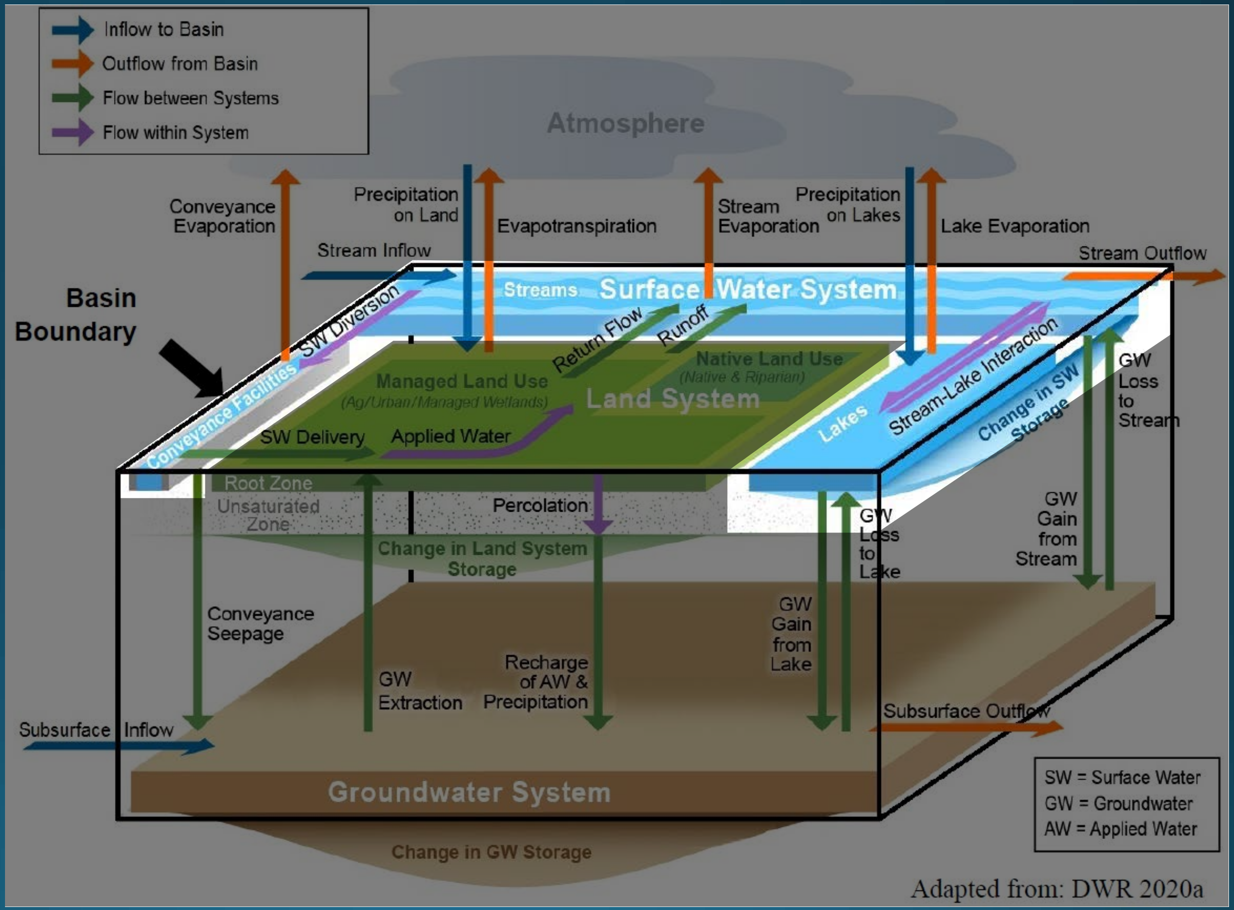
- **Surface Water**
- **Land**
- **Groundwater**



SUBJECT #1: CH 6 WATER BUDGET

Three Systems:

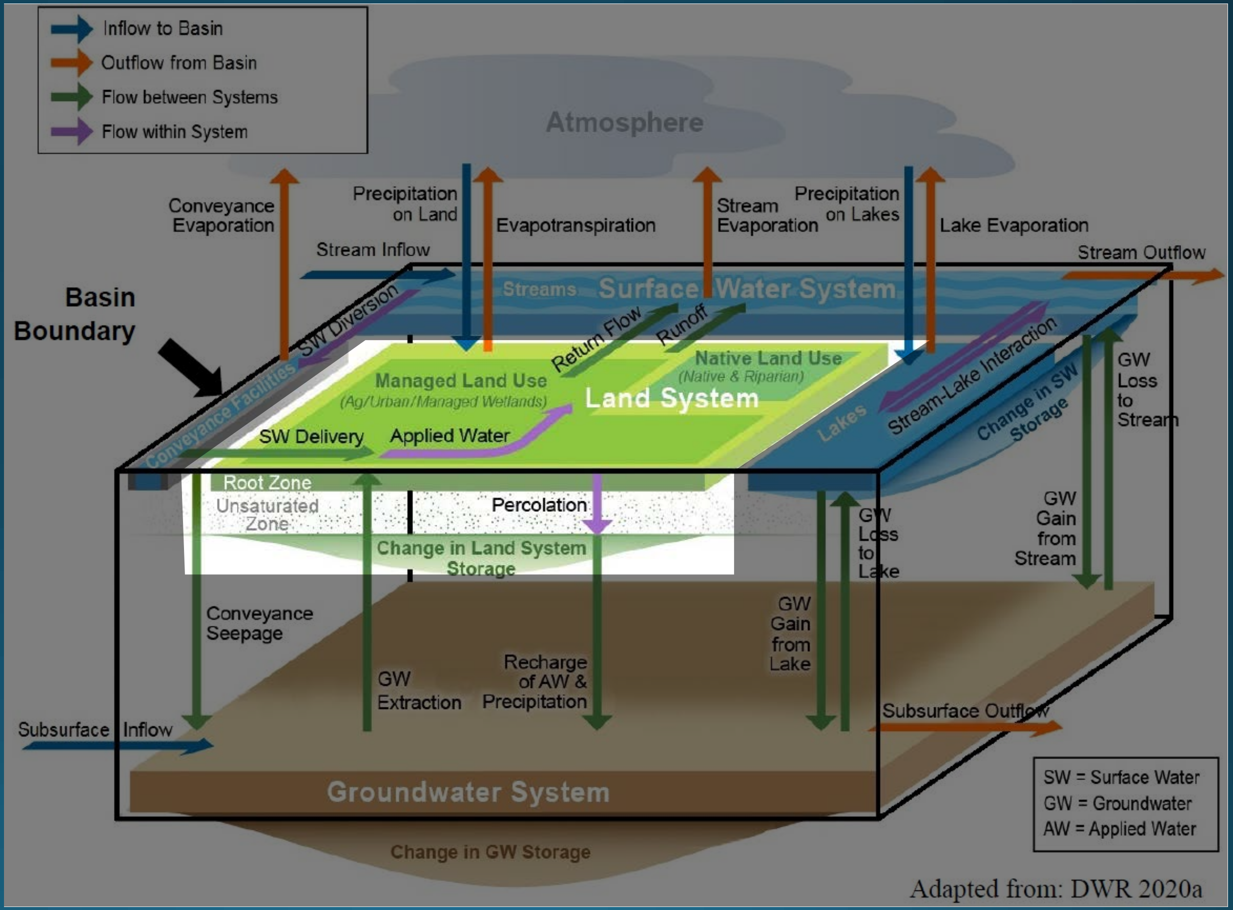
- **Surface Water**
  - **Assume in balance from year to year**
- **Land**
- **Groundwater**



SUBJECT #1: CH 6 WATER BUDGET

Three Systems:

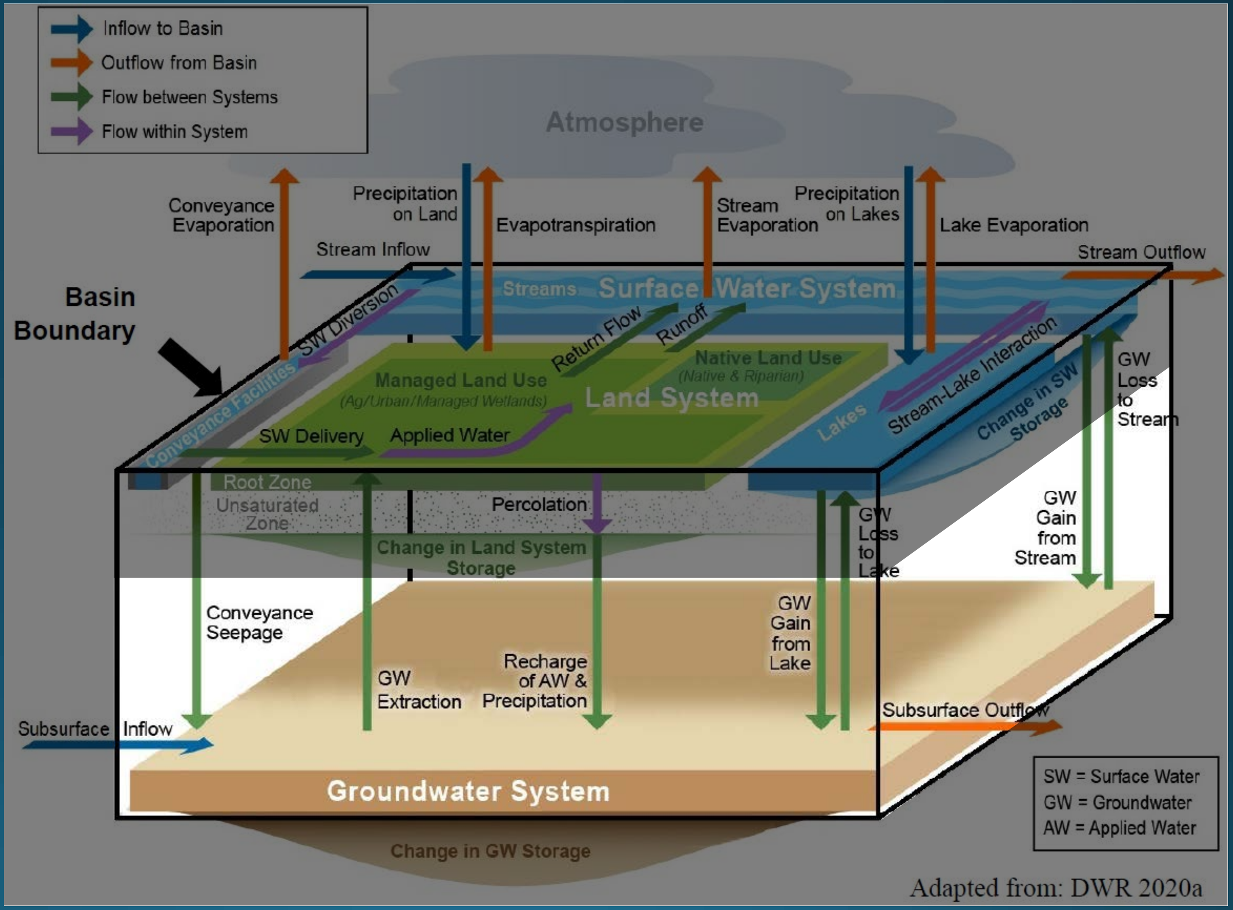
- Surface Water
- **Land**
  - **Assume in balance from year to year**
- Groundwater



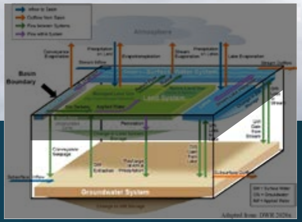
SUBJECT #1: CH 6 WATER BUDGET

Three Systems:

- Surface Water
- Land
- Groundwater
  - Allowed to vary from year to year



SUBJECT #1: CH 6 WATER BUDGET



Groundwater System

Major Inflows:

- Stream Recharge (57%)
- Applied Water Rechg (33%)
- Precipitation Rechg (6%)

Major Outflows:

- Groundwater Extraction (100%)

item	GROUNDWATER SYSTEM			Acre-Feet
	Flow Type	Origin/ Destination	Component	
(8)	Inflow	Between Systems	Recharge of Applied Water	13,923
(9)	Inflow	Between Systems	Recharge of Precipitation	2,703
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	24,037
(22)	Inflow	Between Systems	Groundwater Gain from Lake	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446
(27)	Inflow	Into Basin	Subsurface Inflow	-
(28)	Inflow	(8)+(9)+(10)+(21)+(22)+(20)+(27)	*Total Inflow*	*42,246*
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(15)	Outflow	Between Systems	Groundwater Loss to Stream	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-
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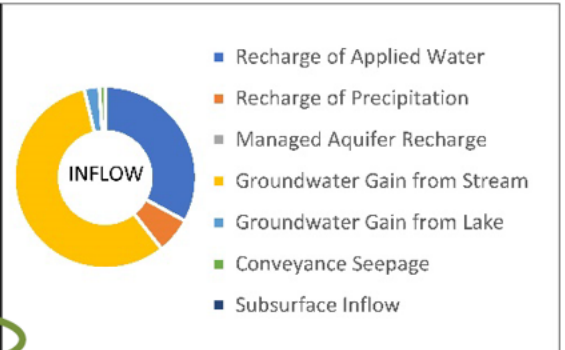


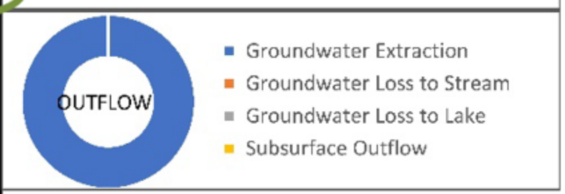
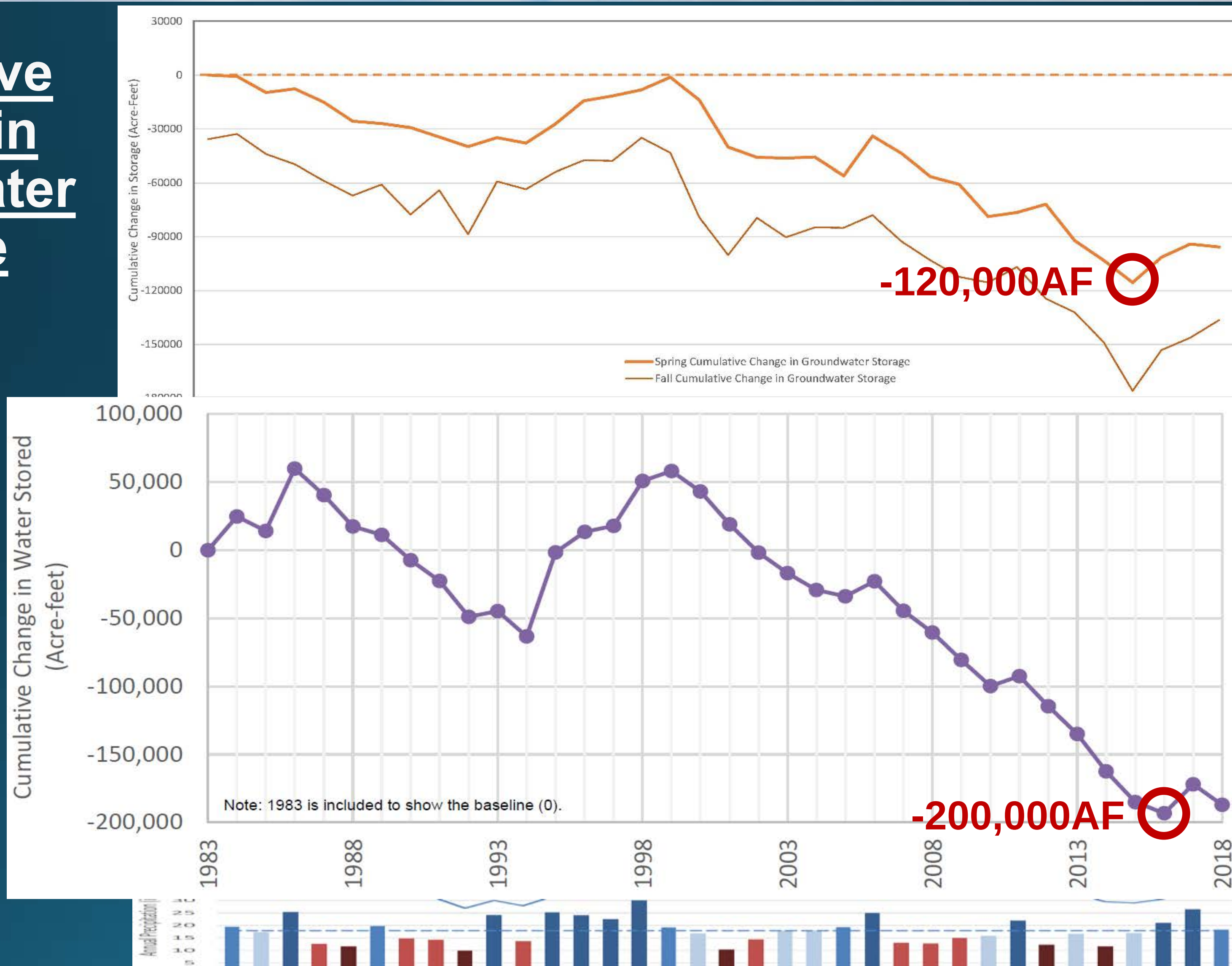


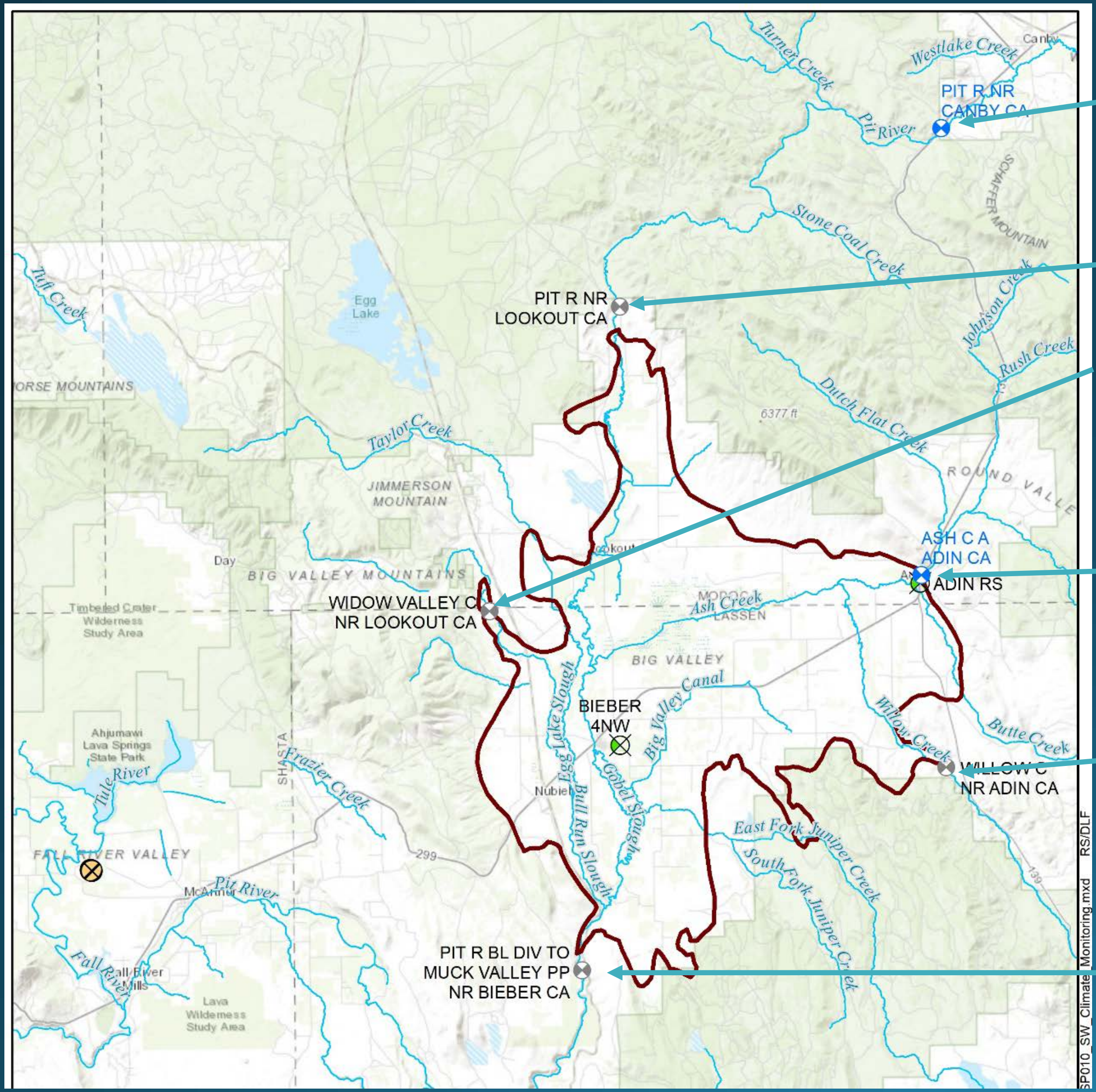
Figure 6-7 Groundwater System Water Budget 1984 to 2018

SUBJECT #1: CH 6 WATER BUDGET

Cumulative Change in Groundwater Storage



SUBJECT #1: CH 6 WATER BUDGET – STREAM INFLOW ESTIMATES



Pit R @Canby 1904-present

Pit R @Lookout 1930-1931 and 1958-1971

Widow Valley Ck 1930-1931

Ash Ck @Adin 1930-1931 and 1958-1971

Willow Ck 1930-1931

Pit R S of Bieber 1952-1975

SUBJECT #1: CH 6 WATER BUDGET – STREAM INFLOW ESTIMATES

Pit R @Canby
vs
Pit R @Lookout

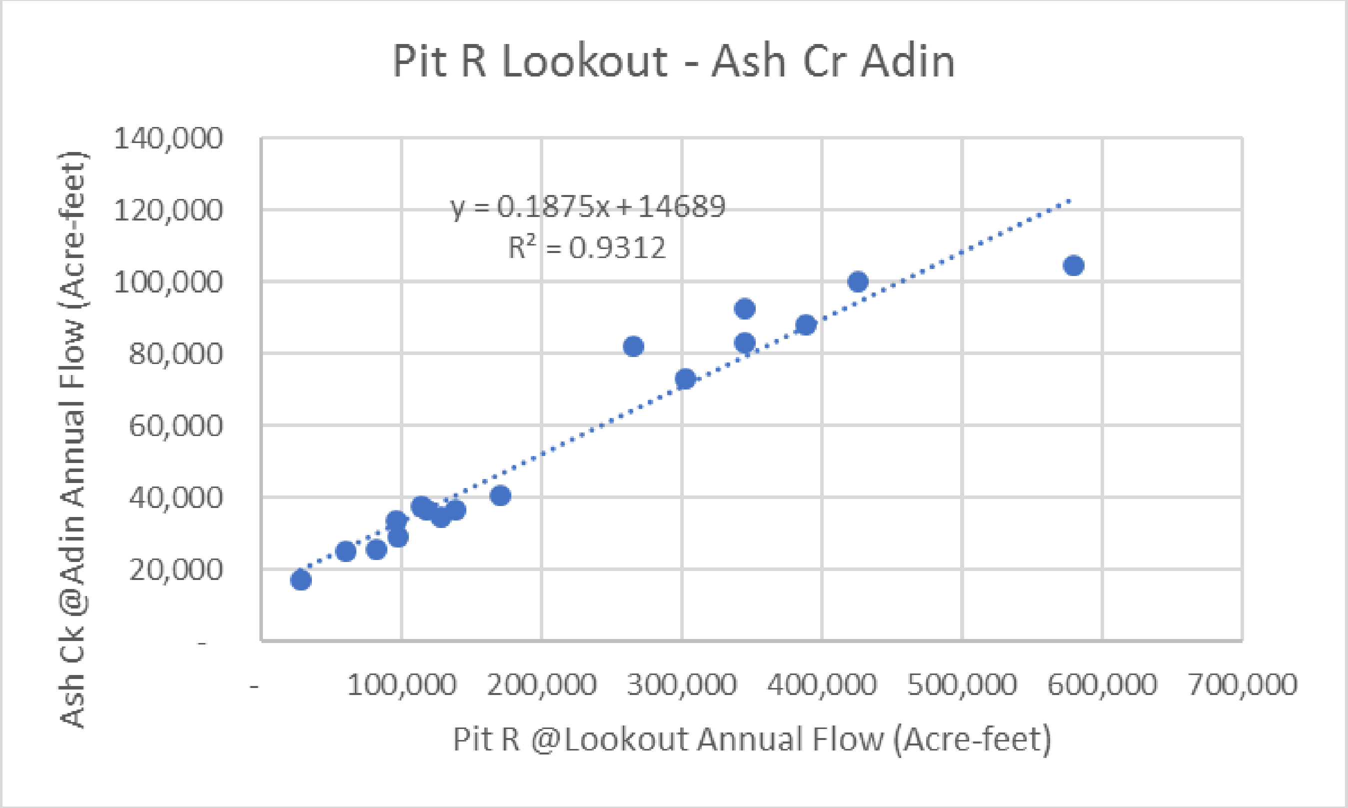
(Historic Relationship)

Month	Correction Factor
Oct	113%
Nov	112%
Dec	125%
Jan	126%
Feb	141%
Mar	154%
Apr	141%
May	111%
Jun	106%
Jul	107%
Aug	96%
Sep	106%

SUBJECT #1: CH 6 WATER BUDGET – STREAM INFLOW ESTIMATES

Pit R @Lookout vs Ash Ck @Adin

(Historic Regression)



SUBJECT #1: CH 6 WATER BUDGET – STREAM INFLOW ESTIMATES

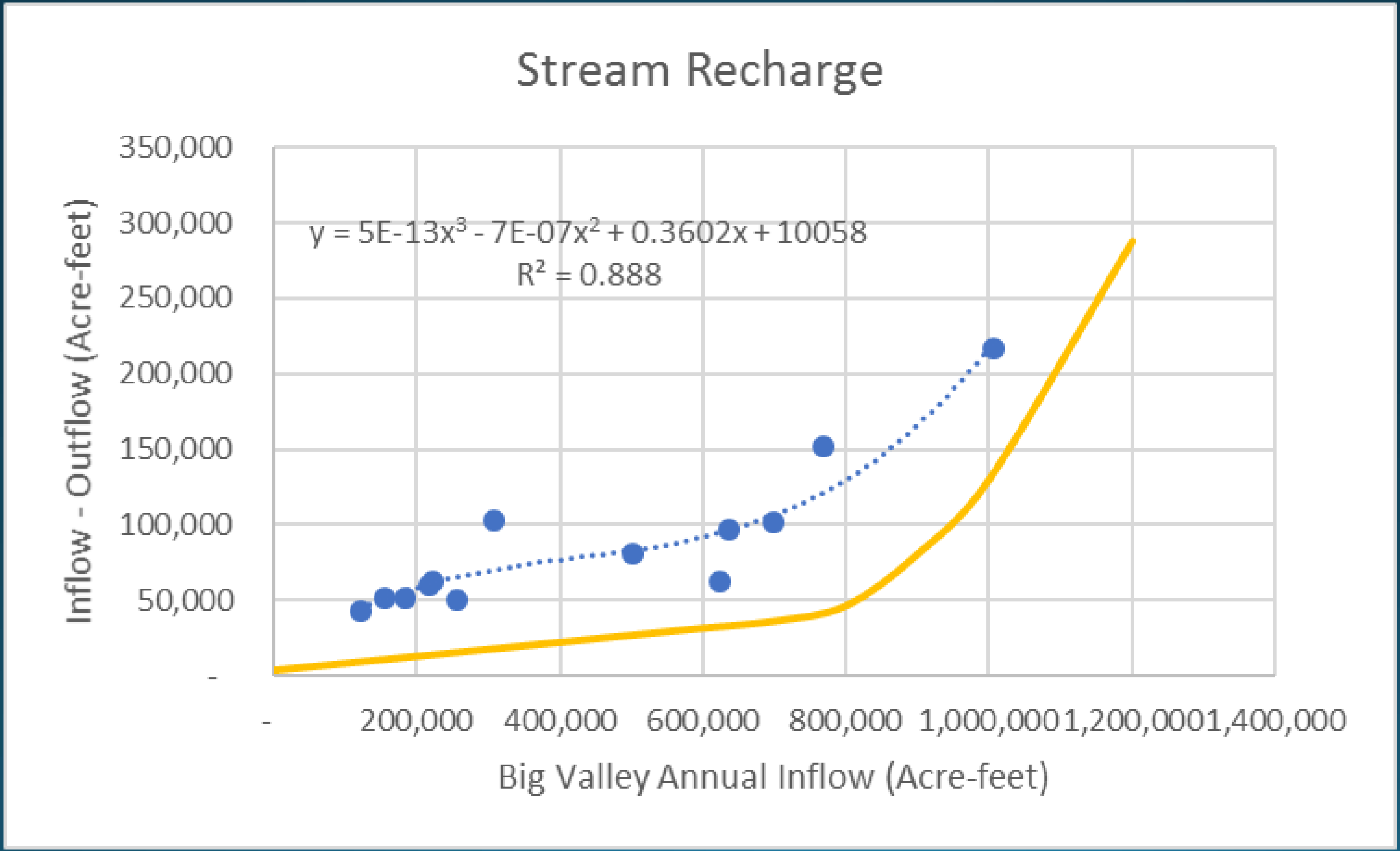
Ungaged Areas

Calculated acre-feet per acre from gaged areas and applied this to the number of ungauged acres

SUBJECT #1: CH 6 WATER BUDGET – STREAM INFLOW ESTIMATES

Stream Recharge

(Historic Regression)

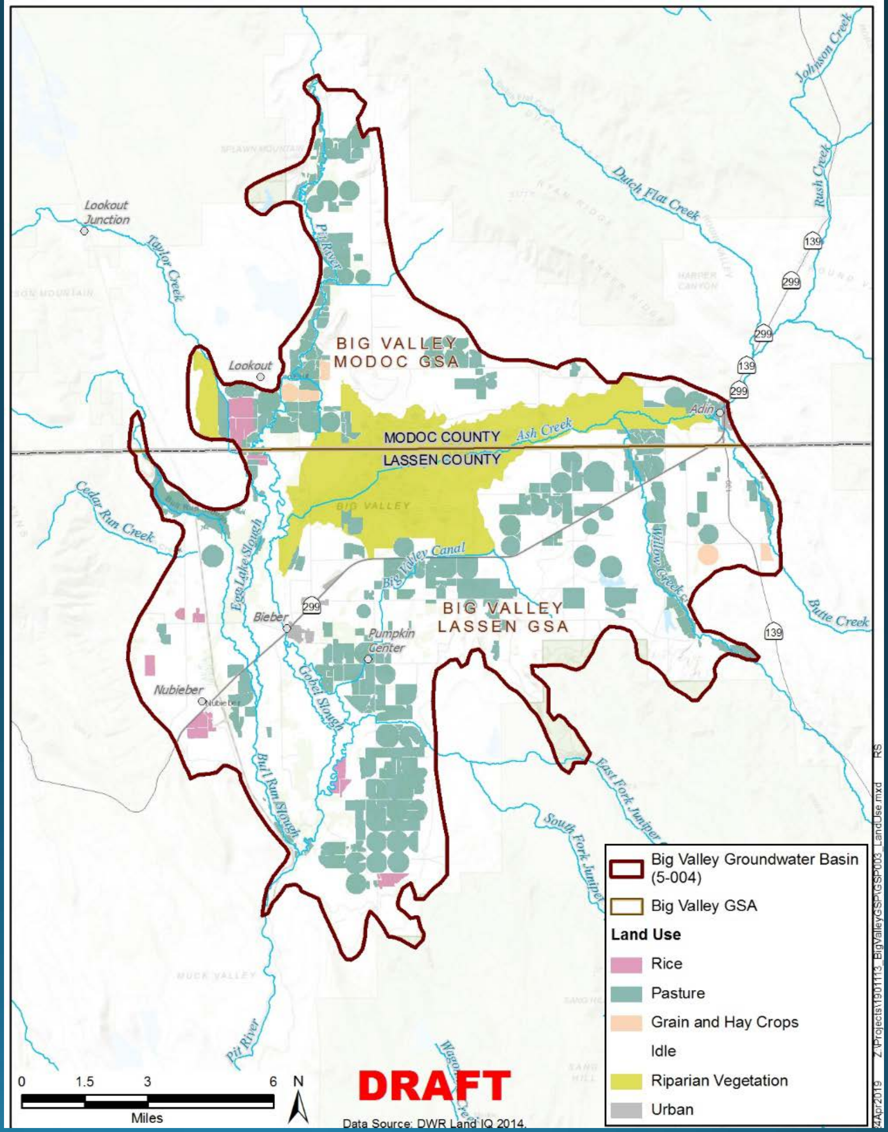


SUBJECT #1: CH 6 WATER BUDGET – EVAPOTRANSPIRATION ESTIMATES

Evapotranspiration

Used 2014 Land Use and determined number of acres of:

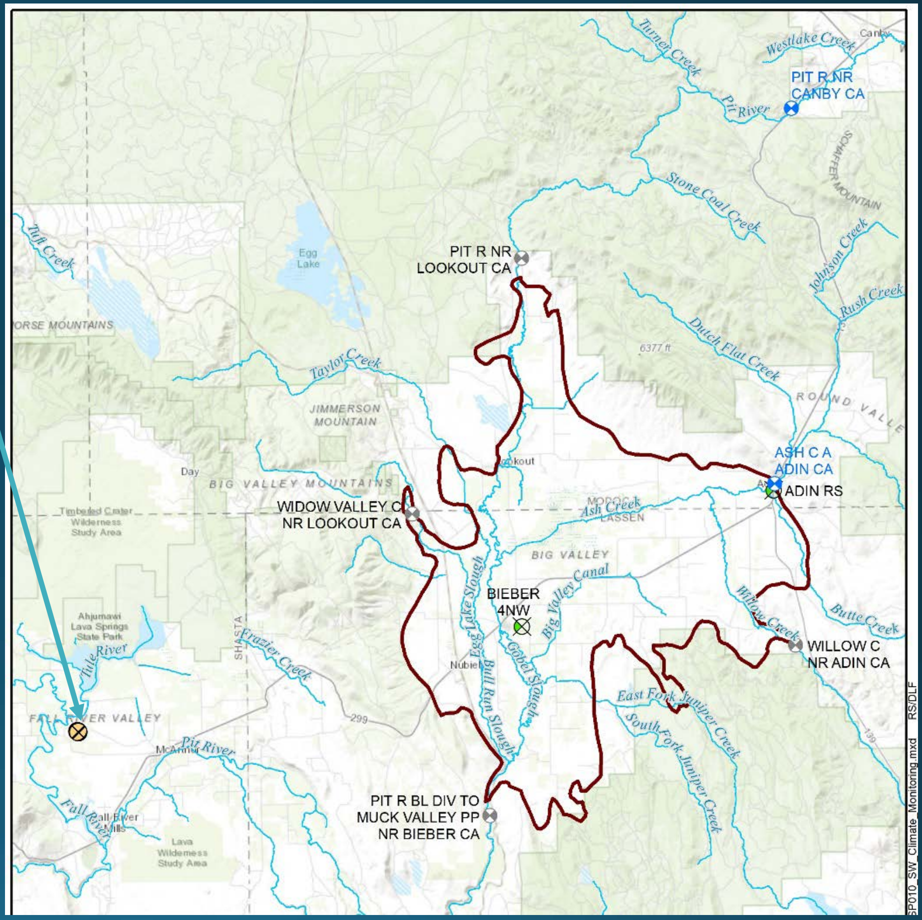
- Alfalfa
- Wild Rice
- Wetlands
- Native Land (unirrigated)



SUBJECT #1: CH 6 WATER BUDGET – EVAPOTRANSPIRATION ESTIMATES

Evapotranspiration

- Used Reference ETo from McArthur CIMIS Station
- Used published crop coefficients to calculate crop demand
- Assumptions:
  - No changes in land use over time
  - Water is applied to meet ET demand + irrigation efficiency of 85%
  - 40% surface water and 60% groundwater to meet irrigation ET demands
  - 98% surface water and 2% groundwater



SUBJECT #1: CH 6 WATER BUDGET – GROUNDWATER INFLOWS

Assumptions

- Recharge of Applied Water
  - 50% of irrigation inefficiency recharges groundwater
- Recharge of Precipitation
  - 2% of precipitation recharges groundwater
- Managed Aquifer Recharge
  - Zero, but hopefully + in the future
- Groundwater gain from stream
  - See previous slide 20
- Groundwater gain from lake
  - Seepage rate of 0.01 feet/day
- Conveyance seepage
  - Seepage rate of 0.01 feet/day

Component	Acre-Feet
Recharge of Applied Water	13,923
Recharge of Precipitation	2,703
Managed Aquifer Recharge	-
Groundwater Gain from Stream	24,037
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Total Inflow	*42,246*
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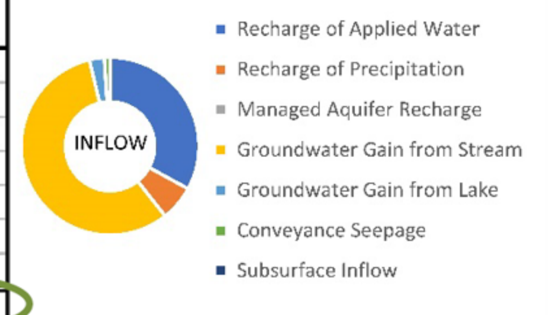

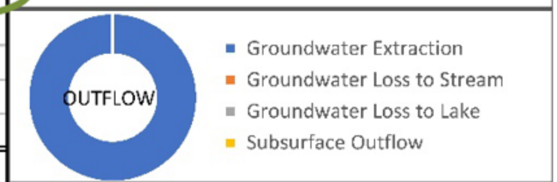

SUBJECT #1: CH 6 WATER BUDGET

Data Needs to Improve Water Budget

- Better surface water inflow and outflow measurements
- Better estimates of precipitation runoff vs percolation
- Better data on applied water and amount of surface water vs groundwater used
- Better information on irrigation efficiencies
  - For each irrigation method

SUBJECT #1: CH 6 WATER BUDGET

Questions and Clarifications?

SUBJECT #1: CH 6 WATER BUDGET

Comments and Discussion

SUBJECT #2: REVISIONS TO CH 5 GROUNDWATER CONDITIONS

Subsidence, Section 5.5, pages 5-22 to 5-24	**How do the measurements account for agricultural practices that affect ground level? That should be discussed. Subsidence may not be due to changes in groundwater levels. It could be compaction, grazing land converted to row crops - with soils used to enhance levees. Or earthwork done at Caltrans. Or erosion. There may be other actions affecting ground levels, such as new ground disturbance.** **• Consider a footnote on land use, saying that additional on-ground monitoring is needed. Explain that these measurements show where ground is lower or higher.**

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chapter 5	Subsidence, Section 5.5, pages 5-22 to 5-24	**How do the measurements account for agricultural practices that affect ground level? That should be discussed. Subsidence may not be due to changes in groundwater levels. It could be compaction, grazing land converted to row crops - with soils used to enhance levees. Or earthwork done at Caltrans. Or erosion. There may be other actions affecting ground levels, such as new ground disturbance.**	9/24/2020	Subsidence associated with groundwater dynamics and pumping generally result in "bulls-eye" patterns of subsidence. Some of the subsidence in Big Valley is likely due to oxidation of organic materials. There are other options for monitoring subsidence, including the survey markers embedded in the new well monitoring foundations.
		Table 5.5, page **• Alfalfa is listed as a native species – change this** • Is aspen found in the basin? • Is elderberry found in the basin? **• Change "salix" to "willow"**		question is about managing for GDEs, w.hich comes later Species listings are obtained from the Native CalFlora website. The Nature Conservancy website was also reviewed and many of the species listed were deleted for the Big Valley GSP. Changes made to text to address alfalfa as a non-native species and changing salix to willow
Public Draft Chapter 5	GDEs	Do not say that Ash Crrek is "managed" Descriptions of GDEs should be verified by those who are working on the land	9/24/2020	Chapter 5 does not contain the word "managed" or "managed wetlands" - the area is referred to as Ash Creek Wildlife Area
Public Draft Chapter 5	River reaches: Page 5-25 b and c	**• Reaches 6 and 9 are both labled Upper Pit River** • Reach 3 is Willow Creek: water rights and diversions mean that Willow Creek does not exist after a certain point during the summer	9/24/2020	Change made to reach 9 labeling it Lower Pit River Text added to description of Reach 3 that clarifies that most of the water is diverted to reservoirs and lands adjacent to the creek.
Public Draft Chapter 5		Referring to the Elements checklist guide, there was a question about which items are required.	9/24/2020	Clarification was provided during the presentation.

SUBJECT #2: REVISIONS TO CH 5 GROUNDWATER CONDITIONS

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chapter 5	Subsidence, Section 5.5 [illegible] 24	How do the measurements account for agricultural practices that affect ground level? That should be discussed. Subsidence may not be due to changes in groundwater levels. [illegible] crops - with soils used to enhance levees. Or earthwork done at Caltrans. Or erosion. There may be other actions affecting ground levels, such as new ground disturbance.	9/24/2020	Subsidence associated with groundwater dynamics and pumping generally result in "bulls-eye" patterns of subsidence. Some of the subsidence in Big Valley is likely due to oxidation of organic materials. There are other options for monitoring subsidence, including the survey markers embedded in the new well monitoring foundations.
		• Change "salix" to "willow"		were deleted for the Big Valley GSP. Changes made to text to address alfalfa as a non-native species and changing salix to willow

INTRODUCTION CHANGES

5.5 Subsidence §354.16(e)

Vertical displacement of the land surface (subsidence) is comprised of two components: 1) elastic displacement which fluctuates according to various cycles (daily, seasonally, and annually) due to temporary changes in hydrostatic pressure (e.g. atmospheric pressure and changes in groundwater levels) and 2) inelastic displacement or permanent subsidence which can occur from a variety of natural and human-caused phenomena, including~~when~~ groundwater pumping. Lowering of groundwater levels can cause~~s a~~ prolonged and/or extreme decrease in hydrostatic pressure of the aquifer. This decrease in pressure can allow the aquifer to compress, primarily within fine-grained beds (clays). Inelastic subsidence cannot be restored after the hydrostatic pressure increases. Other causes of inelastic subsidence include natural geologic processes (e.g. faulting) and the oxidation of organic rich (peat) soils as well as human-caused processes such as mining and grading of land surfaces for agricultural use.

CONCLUSION CHANGES

Two localized areas of subsidence exceeding -1.5 inches are apparent from this data, one in the east-central portion of the basin north of Highway 299 and one in the southern portion of the Basin between the Pit River and Bull Run Slough. Maximum downward displacement in the Basin is -3.3 inches, or -0.77 inches per year over the 4.3-year period. It is unknown if the subsidence in these areas has been induced by groundwater extraction.

SUBJECT #2: REVISIONS TO CH 5 GROUNDWATER CONDITIONS

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chapter 5	Subsidence, Section 5.5, pages 5-22 to 5-24	**How do the measurements account for agricultural practices that affect ground level? That should be discussed. Subsidence may not be due to changes in groundwater levels. It could be compaction, grazing land converted to row crops - with soils used to enhance levees. Or earthwork done at Caltrans. Or erosion. There may be other actions affecting ground levels, such as new ground disturbance.** **• Consider a footnote on land use, saying that additional on-ground monitoring is needed. Explain that these measurements show where ground is lower or higher.**	9/24/2020	Subsidence associated with groundwater dynamics and pumping generally result in "bulls-eye" patterns of subsidence. Some of the subsidence in Big Valley is likely due to oxidation of organic materials. There are other options for monitoring subsidence, including the survey markers embedded in the new well monitoring foundations. A key consideration is where groundlevel changes are due to groundwater pumping are undesirable. Added text expanding on different causes of subsidence and clarification that subsidence observed via InSAR may not be induced by groundwater extraction.
	GDEs, Sec. 5.7, pages 5-26 to 5-31	• The acreage for amount of willows in the basin is overstated. There is not 4,700 acres of willows in the basin. • Ash Creek Refuge uses surface water supplies. There was discussion about groundwater levels in that specific area, which are closer to the surface and contribute to surface water supplies. Table 5.5, page **• Alfalfa is listed as a native species – change this** • Is aspen found in the basin? • Is elderberry found in the basin? **• Change "salix" to "willow"**		Changes made to text to address alfalfa as a non-native species and changing salix to willow
Public Draft Chapter 5	GDEs	Do not say that Ash Crrek is "managed" Descriptions of GDEs should be verified by those who are working on the land	9/24/2020	Chapter 5 does not contain the word "managed" or "managed wetlands" - the area is referred to as Ash Creek Wildlife Area
Public Draft Chapter 5	River reaches: Page 5-25 b and c	**• Reaches 6 and 9 are both labled Upper Pit River** • Reach 3 is Willow Creek: water rights and diversions mean that Willow Creek does not exist after a certain point during the summer	9/24/2020	Change made to reach 9 labeling it Lower Pit River Text added to description of Reach 3 that clarifies that most of the water is diverted to reservoirs and lands adjacent to the creek.
Public Draft Chapter 5		Referring to the Elements checklist guide, there was a question about which items are required.	9/24/2020	Clarification was provided during the presentation.

SUBJECT #2: REVISIONS TO CH 5 GROUNDWATER CONDITIONS

CHANGES TO TABLE 5-5

Table 5-5 Big Valley ~~Native~~ Common Plant Species Rooting Depths

Species	Rooting Depth
Carex spp.	Up to 5 ft
Alfalfa	9 feet
Aspen	10 feet and less
Salix spp.	2-10 feet
Elderberry	10 feet and less
Saltgrass	2 feet

Sources: CNPS 2020, TNC 2020, Snell 2020

Species	Rooting Depth
Carex spp.	Up to 5 ft
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Sources: CNPS 2020, TNC 2020, Snell 2020

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chapter 5	Section 5.5 pages 5-22 to 5-	How do the measurements account for agricultural practices that affect ground level? ... It could be compaction, grazing land converted to row crops - with soils used to enhance	9/24/2020	Subsidence associated with groundwater dynamics and pumping generally result in "bulls-eye" patterns of subsidence. Some of the subsidence in Big Valley is likely due to oxidation of organic materials.
Public Draft Chapter 5		Referring to the Elements checklist guide, there was a question about which items are required.	9/24/2020	Clarification was provided during the presentation.

SUBJECT #2: REVISIONS TO CH 5

Questions and Clarifications?

SUBJECT #2: REVISIONS TO CH 5

Comments and Discussion

SUBJECT #3: NEW STREAM GAGES

BIG VALLEY GROUNDWATER SUSTAINABILITY PLAN (GSP) WATER MEASUREMENT ENHANCEMENT PROJECT

MODOC COUNTY GROUNDWATER SUSTAINABILITY AGENCY

FUNDING FOR THIS PROJECT HAS BEEN PROVIDED IN FULL OR IN PART FROM THE CALIFORNIA DROUGHT, WATER, PARKS, CLIMATE, COASTAL PROTECTION, AND OUTDOOR ACCESS FOR ALL ACT OF 2018 (PROPOSITION 68) AND THROUGH AN AGREEMENT WITH THE STATE DEPARTMENT OF WATER RESOURCES."

NORTH LOCATION FOR STREAM GAGE

REASONING FOR SELECTING THE POTENTIAL STREAM GAGE LOCATION

- EASE OF ACCESS
- CONSISTENT STREAM BANK WITH LOW LEVEL OF ALTERATION DUE TO HIGH FLOWS
- POOL-TO-RIFFLE RELATIONSHIP WHICH CREATES STAGED DATA AND A CONSISTENT RATING TABLE
- LOCATION IS ABOVE ALL WATER PUMPING INTO RIVER FOR USE AS CONVEYANCE
- LOWER FISCAL IMPACT FOR LONG TERM MAINTENANCE OF STREAM GAGE

SOUTH LOCATION FOR STREAM GAGE

REASONING FOR SELECTING THE POTENTIAL STREAM GAGE LOCATION

- EASE OF ACCESS
- CONSISTENT STREAM BANK WITH LOW LEVEL OF ALTERATION DUE TO HIGH FLOWS
- POOL-TO-RIFFLE RELATIONSHIP WHICH CREATES STAGED DATA AND A CONSISTENT RATING TABLE
- RESEARCH OF THIS LOCATION IS IN PROGRESS TO DETERMINE IF LOCATION IS CURRENTLY CONDUCTING MEASUREMENTS AND IF SO REQUESTING TO HAVE THE INFORMATION SHARED WITH THE GSA'S

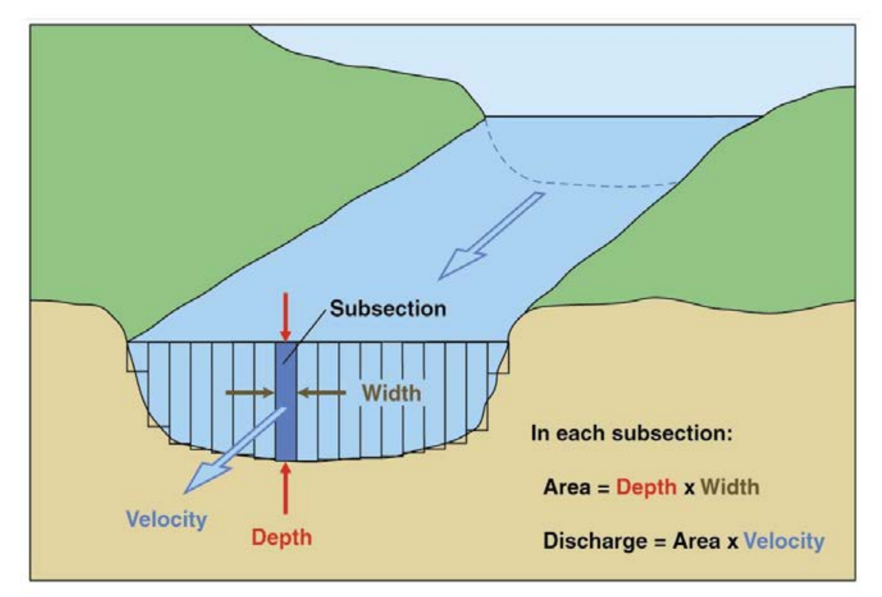
What is a rating curve? Why does it change over time?

In order to convert water height (or “stage”, usually expressed as feet) into a volume of water (or “discharge”, usually expressed as cubic feet per second), USGS hydrographers must establish a relationship between them. This stage-discharge relationship is called a rating curve. It’s developed by making frequent direct discharge measurements at stream gaging stations.
The rating curve depends on the hydraulic characteristics of the stream channel and floodplain, and will vary over time at almost every station.

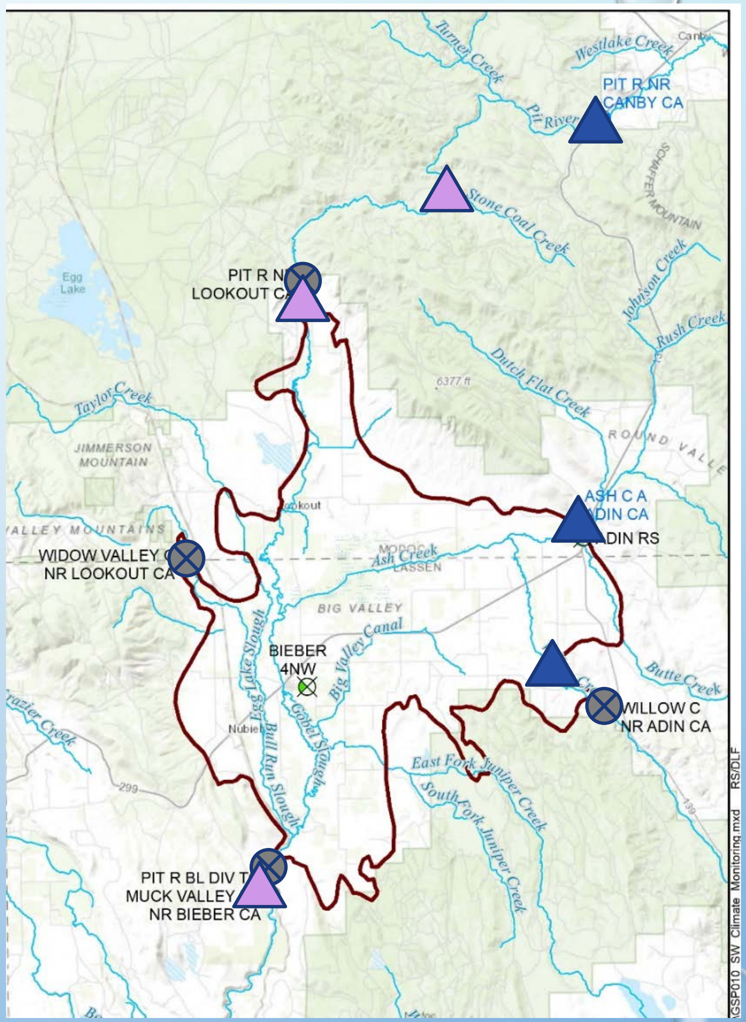
There might be subtle changes to a stream channel, such as the growth of aquatic vegetation in the summer, frequent shifting of a sand-bed stream bottom, catastrophic changes due to floods, or man-made changes such as construction of a bridge. These changes might require only minor or temporary adjustments to streamflow records, or could require a complete reevaluation of the rating curve.

Diagram of Channel Cross Section With Subsections.

THE MOST COMMON METHOD USED BY THE USGS FOR MEASURING VELOCITY IS WITH A CURRENT METER. HOWEVER, A VARIETY OF ADVANCED EQUIPMENT CAN ALSO BE USED TO SENSE STAGE AND MEASURE STREAMFLOW. IN THE SIMPLEST METHOD, A CURRENT METER TURNS WITH THE FLOW OF THE RIVER OR STREAM. THE CURRENT METER IS USED TO MEASURE WATER VELOCITY AT PREDETERMINED POINTS (SUBSECTIONS) ALONG A MARKED LINE, SUSPENDED CABLEWAY, OR BRIDGE ACROSS A RIVER OR STREAM. THE DEPTH OF THE WATER IS ALSO MEASURED AT EACH POINT. THESE VELOCITY AND DEPTH MEASUREMENTS ARE USED TO COMPUTE THE TOTAL VOLUME OF WATER FLOWING PAST THE LINE DURING A SPECIFIC INTERVAL OF TIME. USUALLY A RIVER OR STREAM WILL BE MEASURED AT 25 TO 30 REGULARLY SPACED LOCATIONS ACROSS THE RIVER OR STREAM.



- Historic Gage Location
- Current Gage Location
- Potential New Gage Location



FOR MORE INFORMATION ON STREAM GAGES

- VISIT THE FOLLOWING LINK:

HTTPS://WWW.USGS.GOV/SPECIAL-TOPIC/WATER-SCIENCE-SCHOOL/SCIENCE/HOW-STREAMFLOW-MEASURED?QT-SCIENCE_CENTER_OBJECTS=0#QT-SCIENCE_CENTER_OBJECTS

SUBJECT #3: NEW STREAM GAGES

Questions and Clarifications?

SUBJECT #3: NEW STREAM GAGES

Comments and Discussion

QUESTIONS OR COMMENTS FOR ITEMS NOT ON THE AGENDA

- GSA Staff and Consultants will be available after the meeting to talk, answer questions, and hear your concerns.