WORKSHOP SERIES 1 – OCTOBER 2018

Floodplain Harvesting in NSW

Daniel Connor – Healthy Floodplains Project Lead
Daniel Blacker – Director, Water Programs & Performance

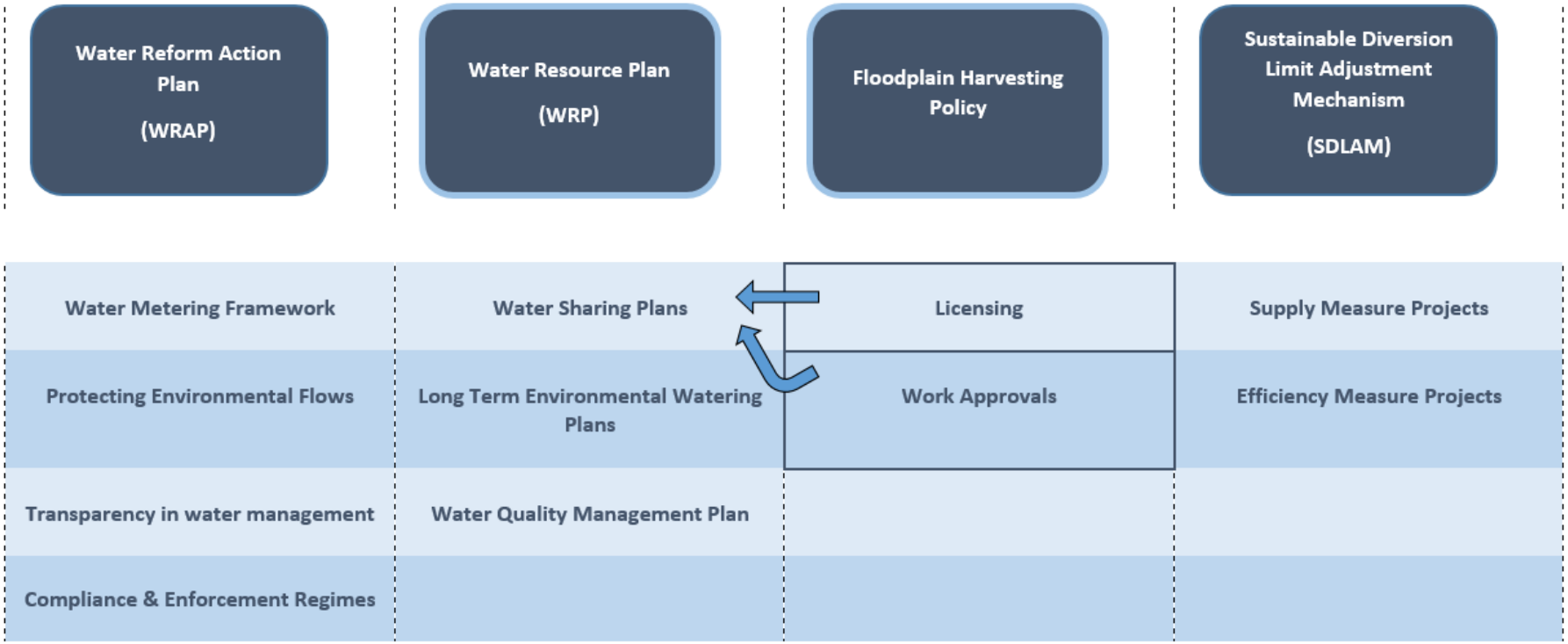
Floodplain Harvesting engagement – today's agenda

- Welcome & session overview
- Context: NSW and MDB perspectives:
  - Regulatory frameworks
  - Modelling & assumptions
  - Opportunities for feedback
- Technical presentations:
  - Modelling
  - Data sources & checks
  - Peer-review process
  - Monitoring & auditing
- Next steps:
  - Opportunities for feedback

Floodplain Harvesting engagement - overview

- NSW Government has decided to regulate the practice of Floodplain Harvesting – we are now moving into modelling and implementation of this policy
  - Today's focus is ***not*** on the policy decision
  - Today's focus ***is*** on implementation, modelling, auditing and monitoring
- Purpose of this meeting:
  - Outline the process to give feedback on the methodology
  - Outline the process for finalising floodplain harvesting modelling
  - Outline the model refinement process (including data sources & verification processes)
  - Test key modelling assumptions
  - Meet the team, including peer reviewers

Water Reform in NSW – an ongoing process



NSW GOVERNMENT

Who is responsible for what in water?

State	
Department of Industry – Lands & Water	Responsible for planning, policy development and the regulatory frameworks for regional water in NSW.
Water NSW	Supplies and seeks to improve availability of water in NSW as the state's bulk water supplier and system operator.
Natural Resource Access Regulator	Responsible for compliance and enforcement of the water regulatory framework.
NSW Office of Environment & Heritage	Manages environmental water within NSW and develops long term environmental watering plans as required under the Basin Plan.

Federal	
Murray Darling Basin Authority	Responsible for planning the basin's water resources, with all planning decisions made in the interest of the basin as a whole and prepares, implements and reviews integrated plans for the sustainable use of the basin's water resources.
Commonwealth Environmental Water Holder	Manages the Commonwealth's environmental water holdings to protect and restore environmental assets in the Murray Darling Basin and in other areas where environmental water is held.
Department of Agriculture and Water Resources	Responsible for the management and use of water resources, including the National Water Initiative, the Murray-Darling Basin Plan, urban water policy and reform, and water quality improvement, as well as administering key Commonwealth funding programs relevant to water management reforms.

Floodplain harvesting and the Basin Plan

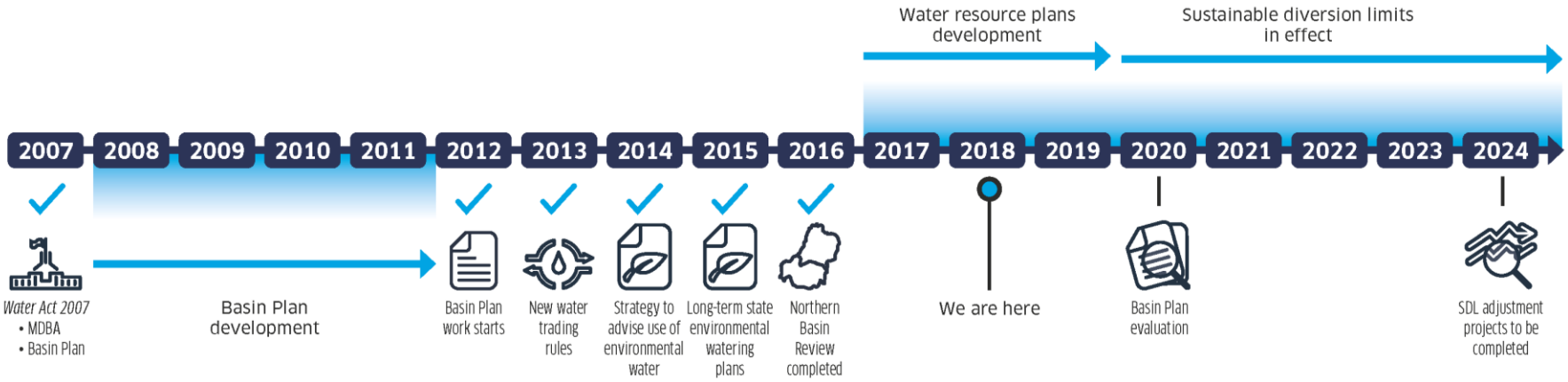
October 2018

Tony McLeod – General Manager,
SDL Accounting and Aboriginal Partnerships

Australian Government

MURRAY–DARLING BASIN AUTHORITY

Basin Plan implementation



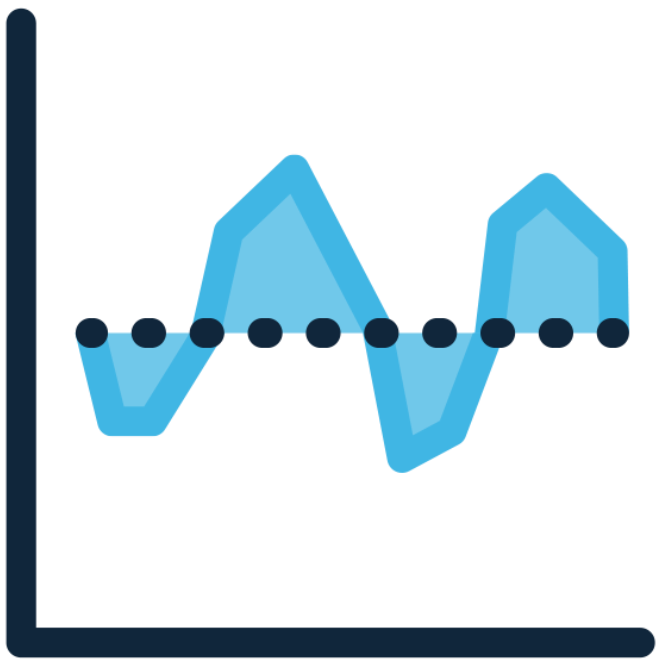
Sustainable diversion limits (SDLs)

- New limits on water use
- Limits for surface water and groundwater
- Science-based targets
- Baseline diversions

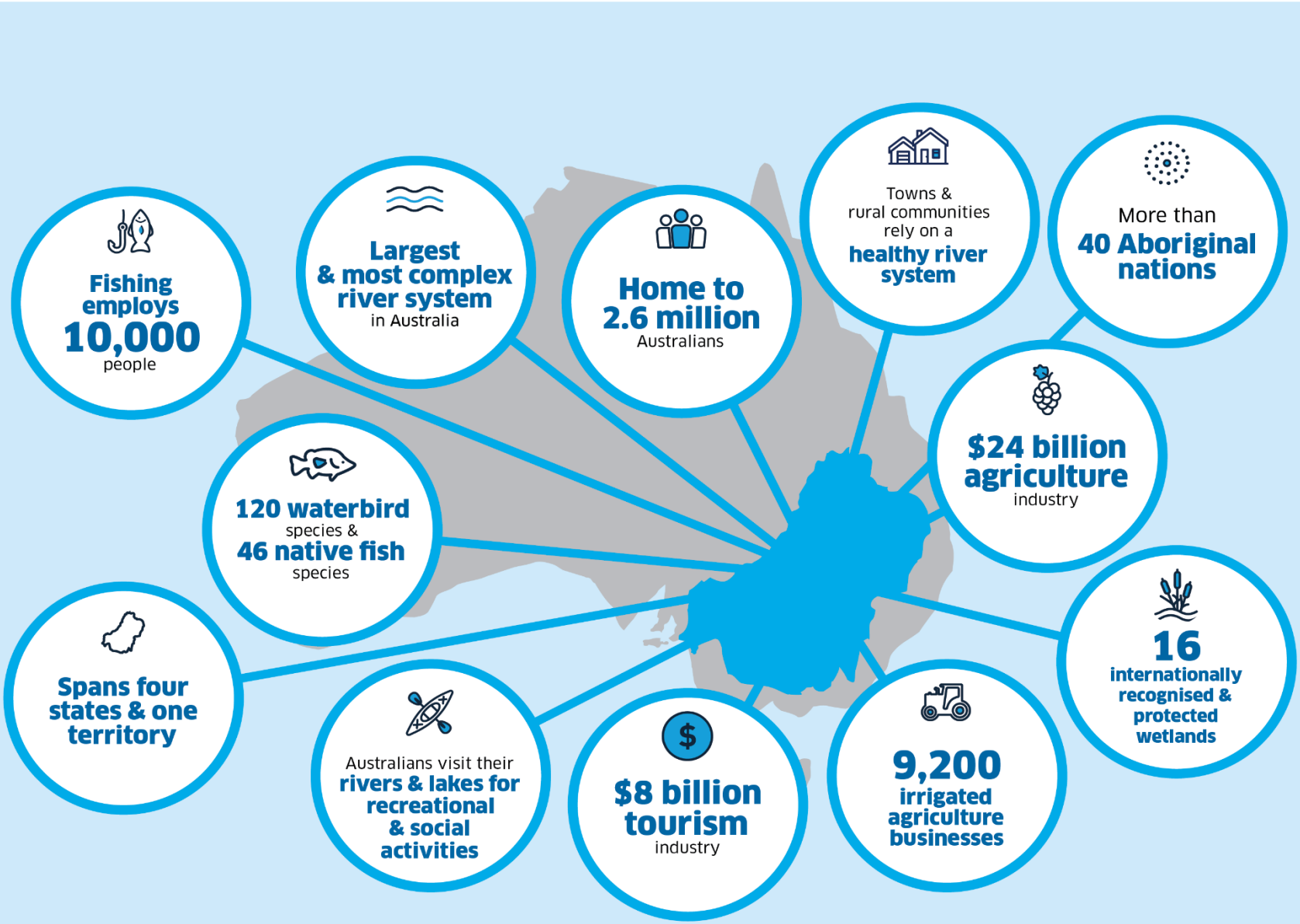
Changes to floodplain harvesting

- Improved measurement and compliance
- MDBA can ensure this use does not exceed the limits

Limits will continue to change



- Floodplain harvesting is not currently licensed and fully accounted for
- Will be incorporated under the Basin Plan
- ***This will see the sustainable diversion limit change***


Fishing employs 10,000 people
Largest & most complex river system in Australia
Home to 2.6 million Australians
Towns & rural communities rely on a healthy river system
More than 40 Aboriginal nations
$24 billion agriculture industry
120 waterbird species & 46 native fish species
Spans four states & one territory
Australians visit their rivers & lakes for recreational & social activities
$8 billion tourism industry
9,200 irrigated agriculture businesses
16 internationally recognised & protected wetlands

Next steps

- This independent review
- Changes will be implemented along with the Basin Plan
- Improved measurement and compliance

NSW Floodplain Harvesting Policy

First introduced by NSW Government, 2013:

- Builds on previous reforms that set statutory water take limits for all take
- Provides a framework for licensing floodplain harvesting - essential for management
- Will reduce, not increase, the volume of water taken in the Northern Basin

Amended by NSW Government, 2018:

- Clarify that floodplain harvesting includes rainfall runoff
- Make special provisions for contaminated rainfall runoff
- Bolster monitoring requirements for floodplain harvesting
- Clarify eligibility criteria for floodplain harvesting
- Provide flexibility for the development of water sharing rules to occur through the water sharing planning process

<u>The NSW Floodplain Harvesting Policy is not up for debate in this forum.</u>

Implementing the NSW Floodplain Harvesting Policy

Ambitious and unprecedented reform for Floodplain management in Australia, necessary to:

- Protect the environment and other water users from the impacts of unconstrained floodplain harvesting
- Provide security and certainty for legitimate floodplain harvesting activities to continue within statutory limits

Modelling – engagement, to date

Who	Why
FPH Modelling Consultative Committee	Set up Irrigator Behaviour Questionnaire
Gwydir Valley Irrigators Association	Pilot valley – incorporating farm scale data/ initial results and individual impacts
NSW Agency	Oversight and advice on model utility
MDBA	WRP accreditation role relies on accepting new BDL estimate as ‘best available’

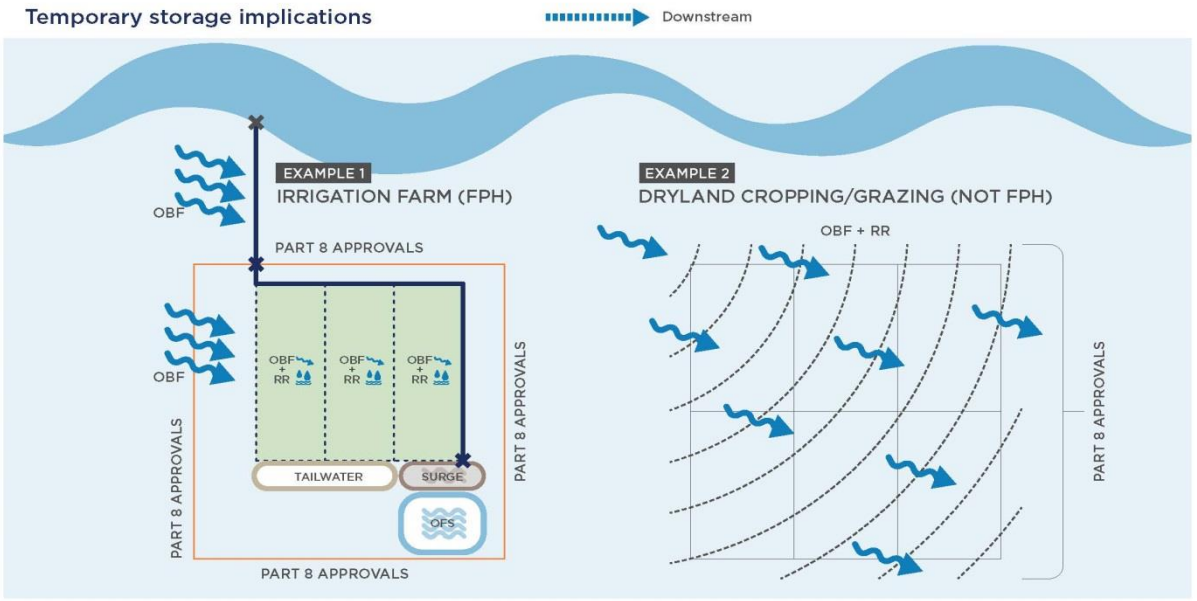
Modelling – addressing stakeholder concerns

Process	Area of concern
Workshop #1 (Oct)	**Why and how models are being revised and key assumptions**
Peer Review (Nov-March)	**That models are based on best available information and are technically robust**
	That Policy implementation is consistent with both legislative and policy requirements
Workshop #2 (May)	How the numbers have changed following peer review
Draft entitlements (May - Nov)	How it effects me as an irrigator

Key modelling assumptions

- Storage evaporation
- Irrigation
- Rainfall runoff
- Overbank flow harvesting
- Defining floodplain harvesting licences

Defining FPH licences



- FPH licences based on water entering permanent storages only
- Assumption considered critical to being able to credibly:
  - re-estimate FPH component of statutory limits
  - monitoring and auditing of FPH diversions

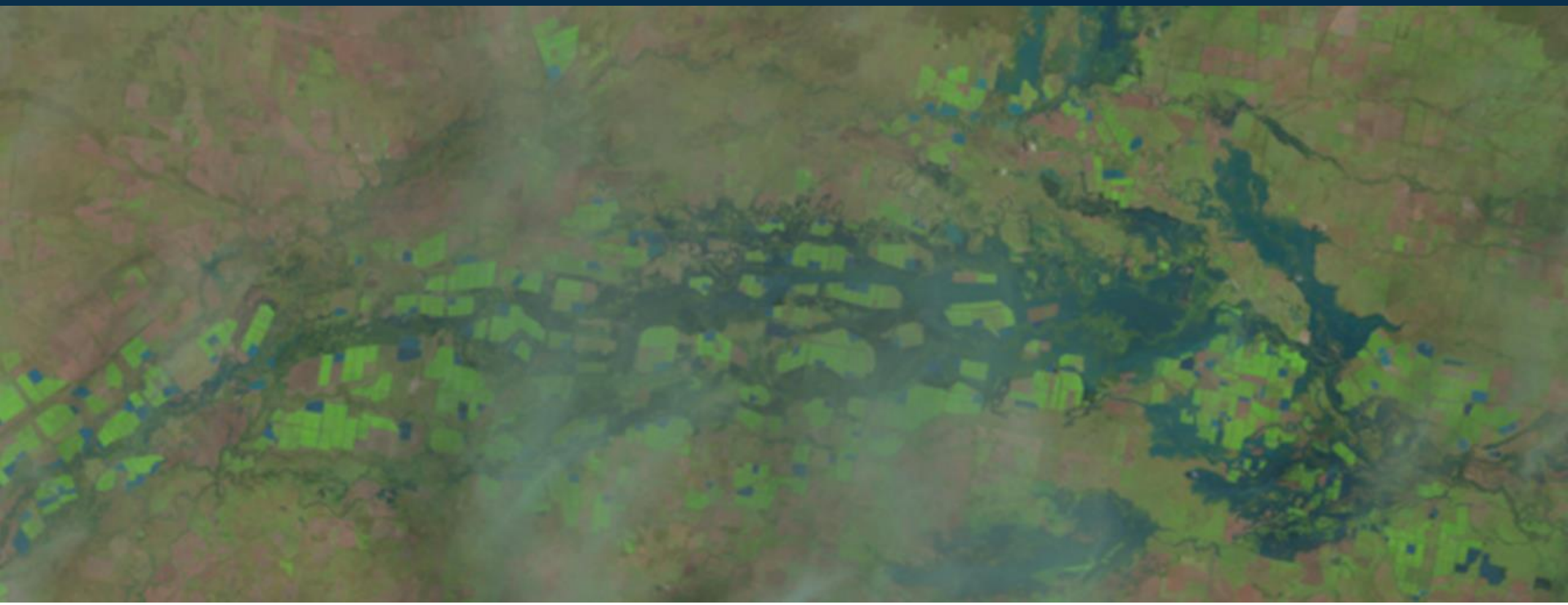
Beneficial flooding and other interceptions

Beneficial flooding

- multiple benefits – environment, grazing, cropping
- not regulated - model accounts for water as losses

Interception activities – one of Basin Plan requirements

- monitor impacts overtime
- if significant impacts – will drive policy response



Questions

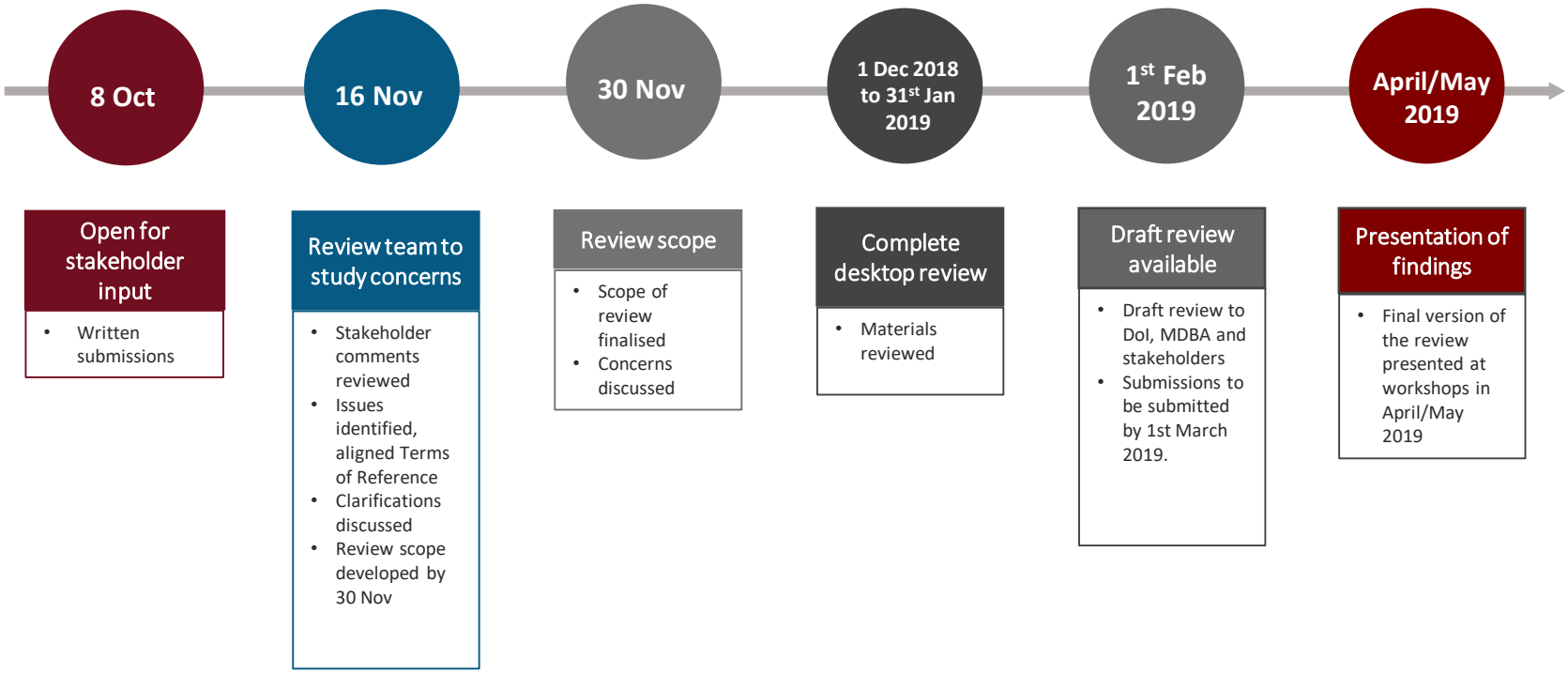
Opportunities for feedback

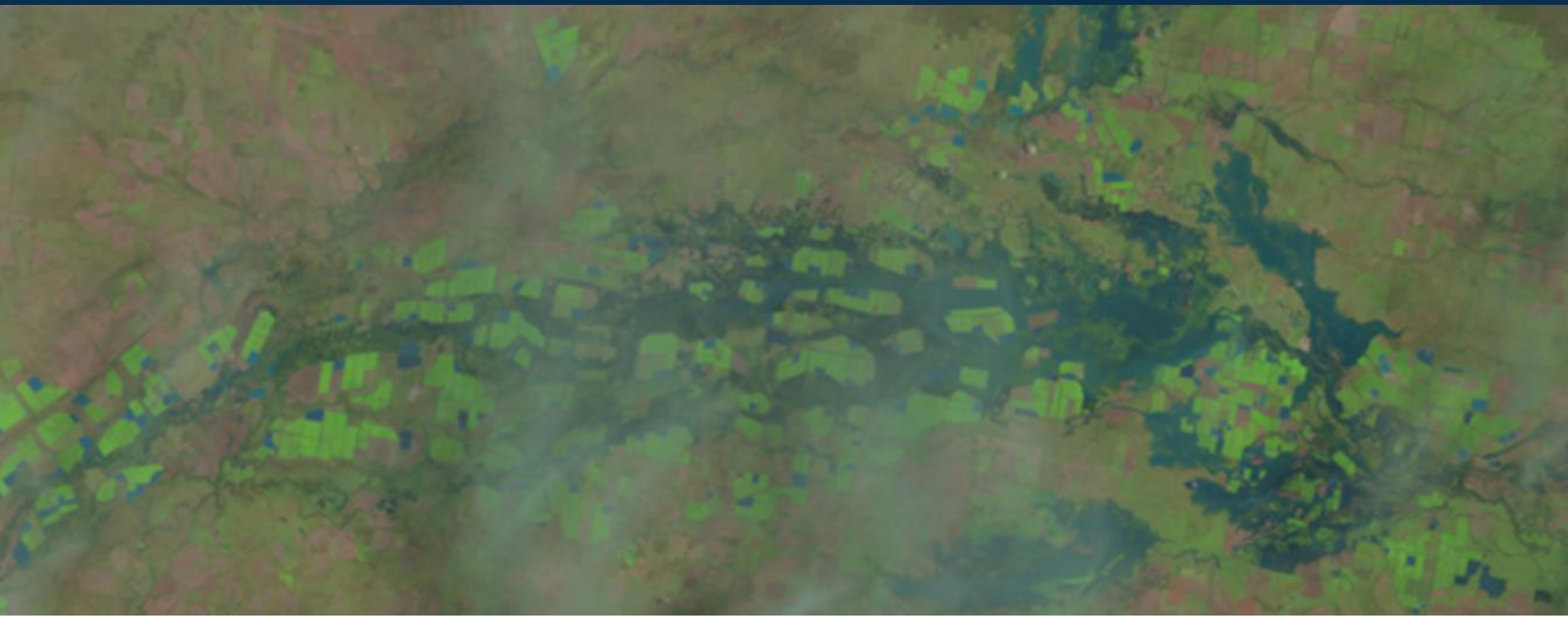
- **Independent reviewers:**

  - Tony Weber:
    - National Leader, Water Modelling - Alluvium Consulting
    - Visiting Scientist, CSIRO

  - Greg Claydon, PSM:
    - Water & NRM Consultant
    - Formerly WA & Qld Water / Environment / Natural Resources / Primary Industries agencies)

Stakeholder consultation framework – FPH Independent Review timeline





Questions

DEPARTMENT OF INDUSTRY WATER

Modelling for estimating floodplain harvesting volumetric entitlements – September 2018

Richard Beecham – Manager, Water Modelling

The challenge

- Modelling responsibility to determine entitlements
- Estimate how much is being taken, allowed, and how to reconcile through entitlements:

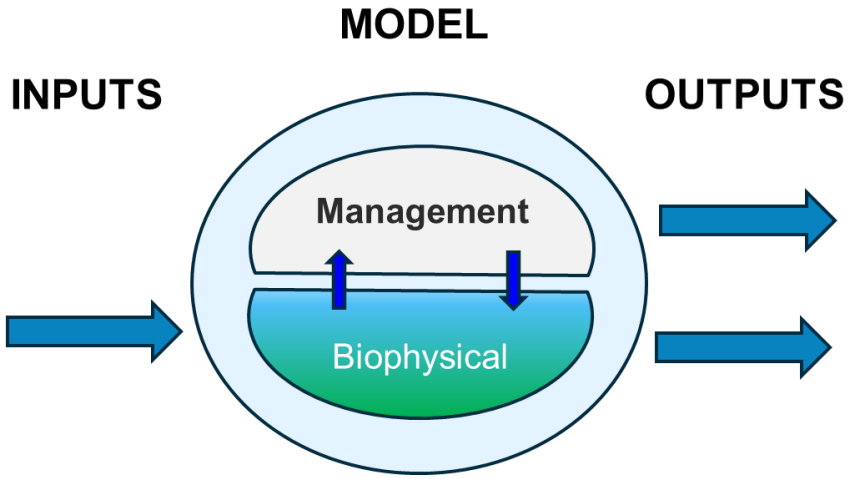
- Pre-existing models fit for prior purposes:
  - Policy, planning, diversion compliance
  - BUT limitations for FPH
- Unprecedented detail and geographic scope
- We welcome your input

Modelling outline

- Existing modelling framework and limitations
- Enhanced modelling process
- Data collection and verification
- Scenarios and entitlements

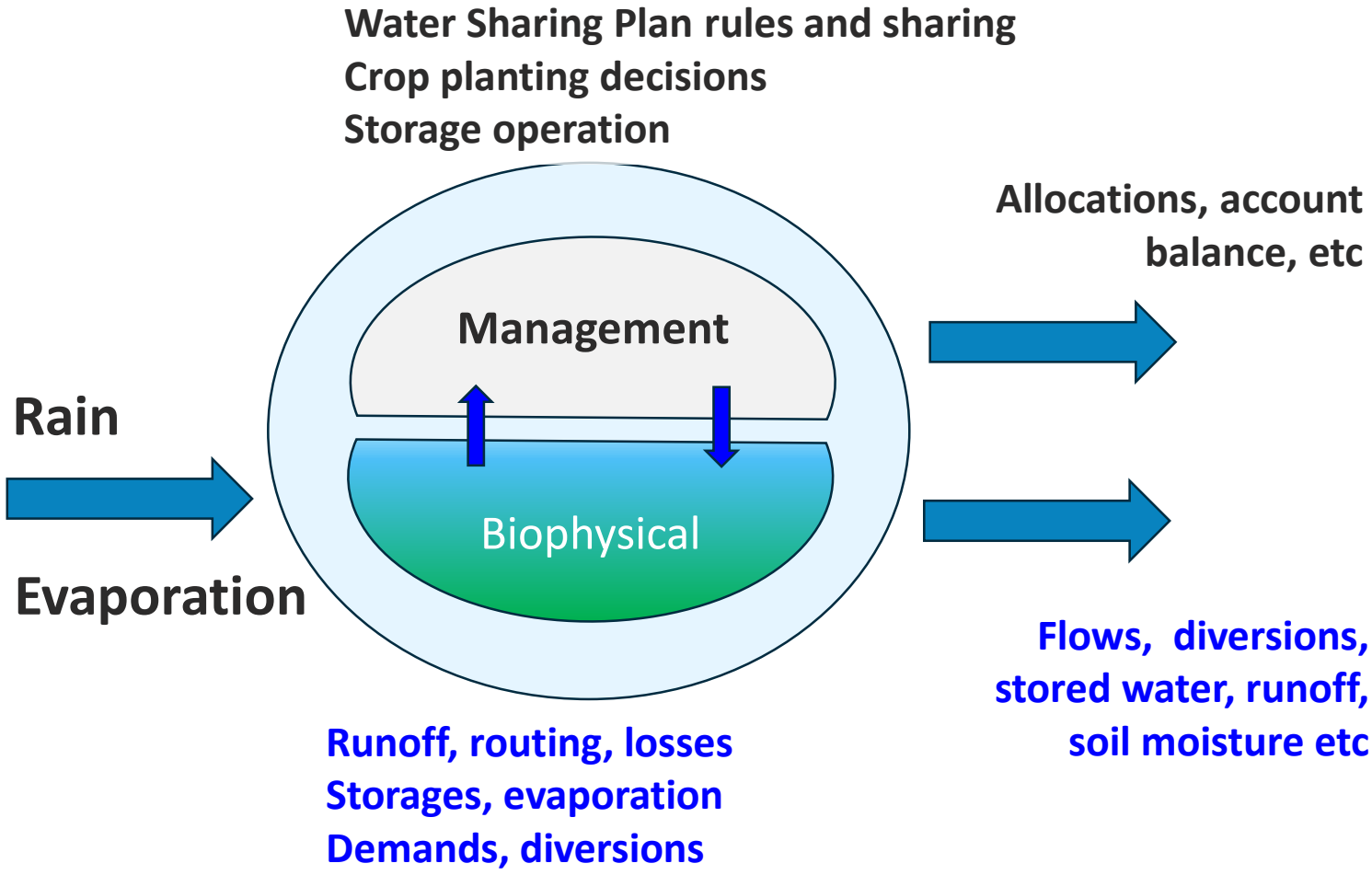
Why we model

- To integrate all key processes that affect water distribution over time and space, within defined catchments



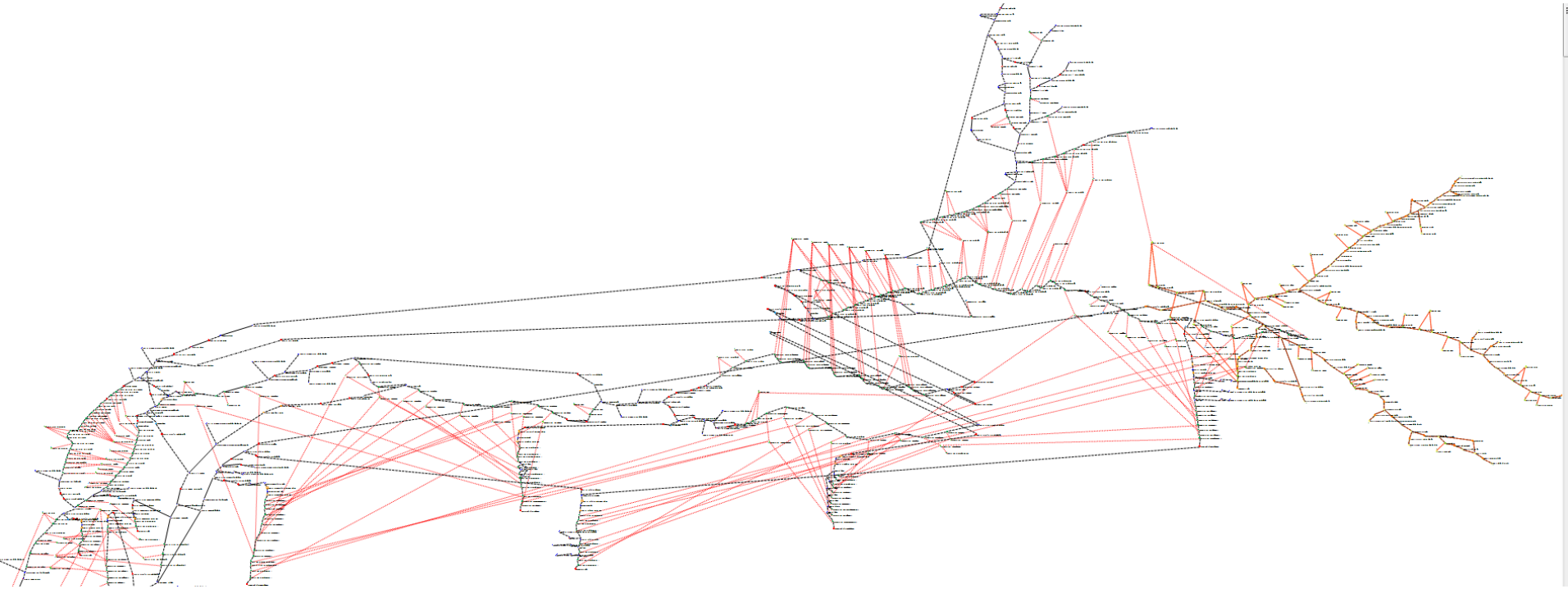
- Objective. Transparent. Consistent. Valid.

Model essentials



Full river system representation:

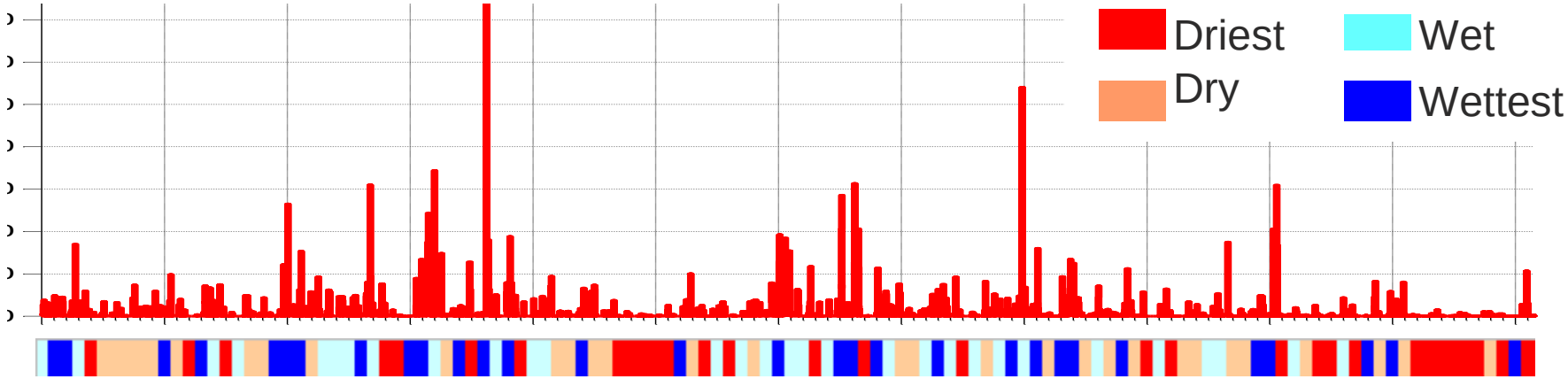
- Addressing complexity



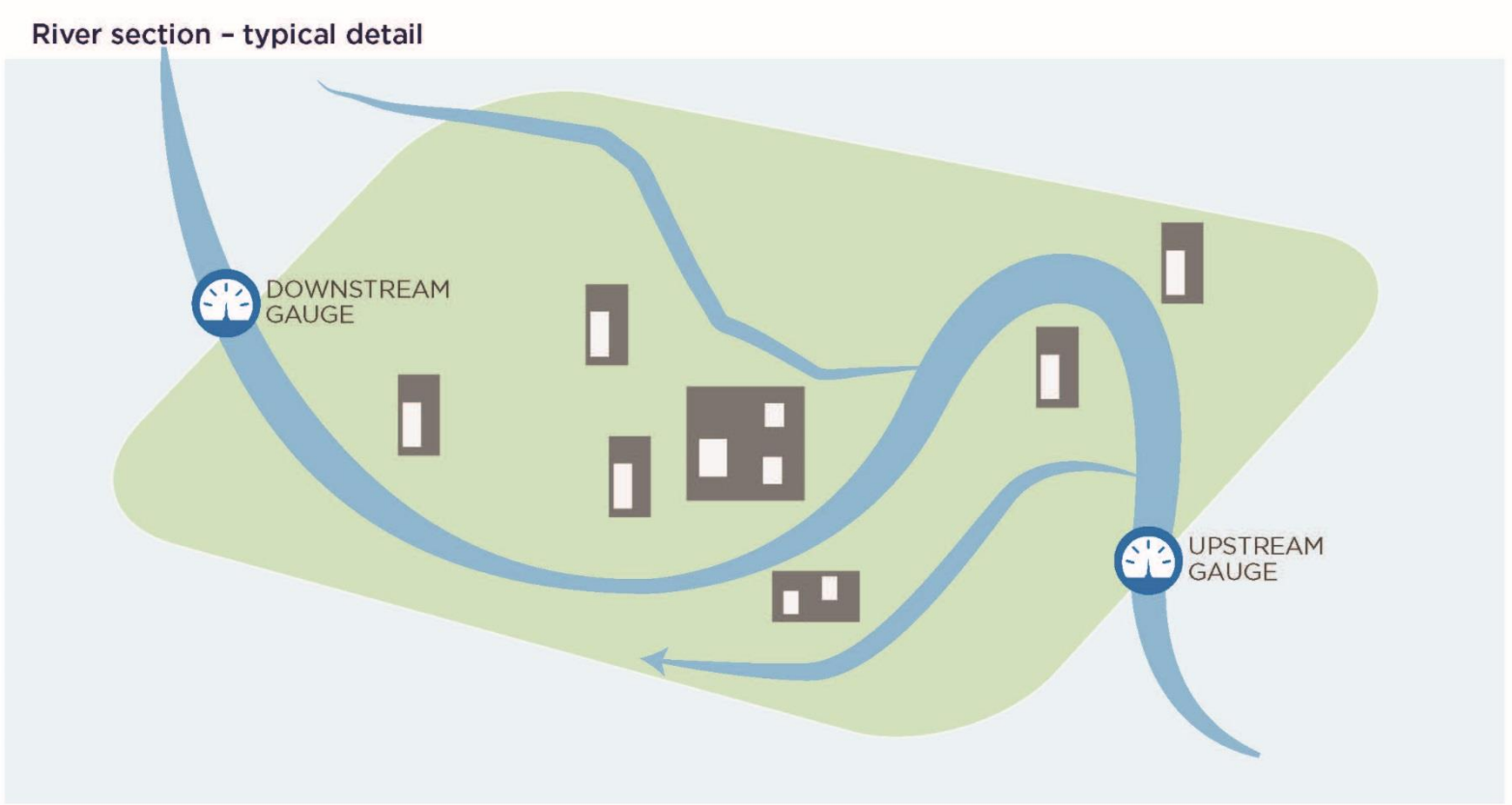
NSW GOVERNMENT

Climate variability

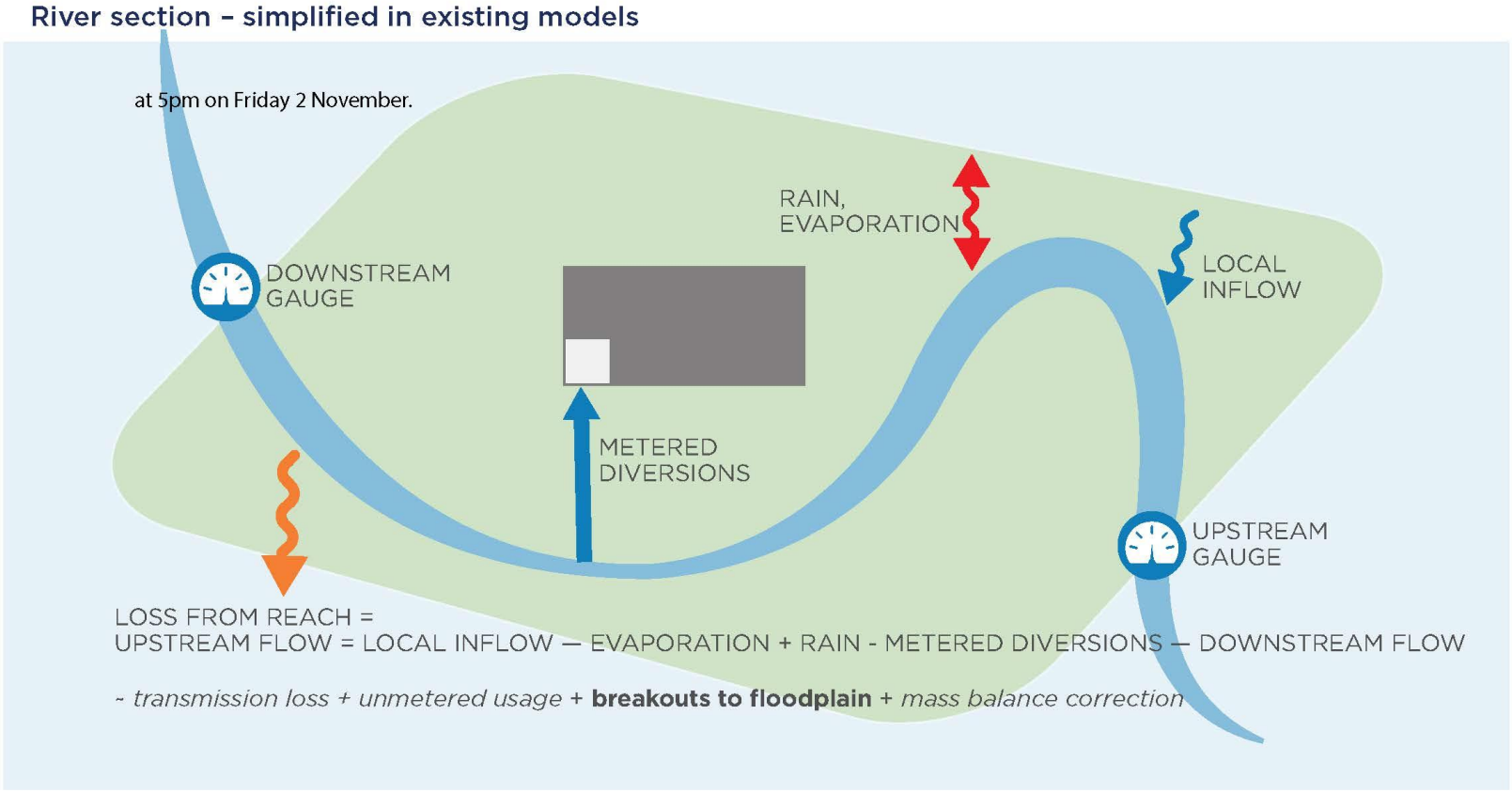
- Long term observed climate used
- Extrapolates recent experience
- Benchmark for comparison



River section – typical detail



River section – simplified in existing models

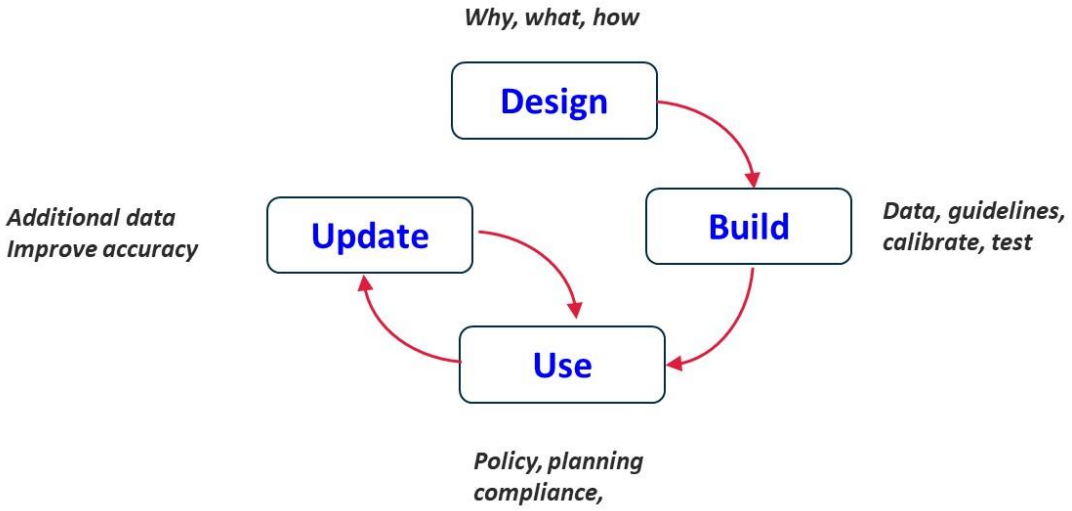


Limitations for implementing policy objectives

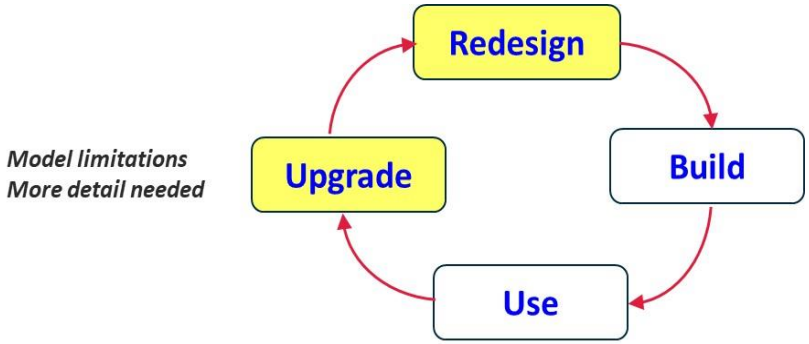
- Existing aggregation of farms does not:
  - allow determination of individual farm water balance based on unique characteristics
  - provide means to limit total diversions.
- Assumptions in system loss estimates and crop water usage contribute to existing uncertainty.
- Explicit attention to these assumptions to reduce (not eliminate) uncertainty
- More data and enhancements to modelling.

Model improvement – accuracy and capability

Accuracy – Continual -incremental

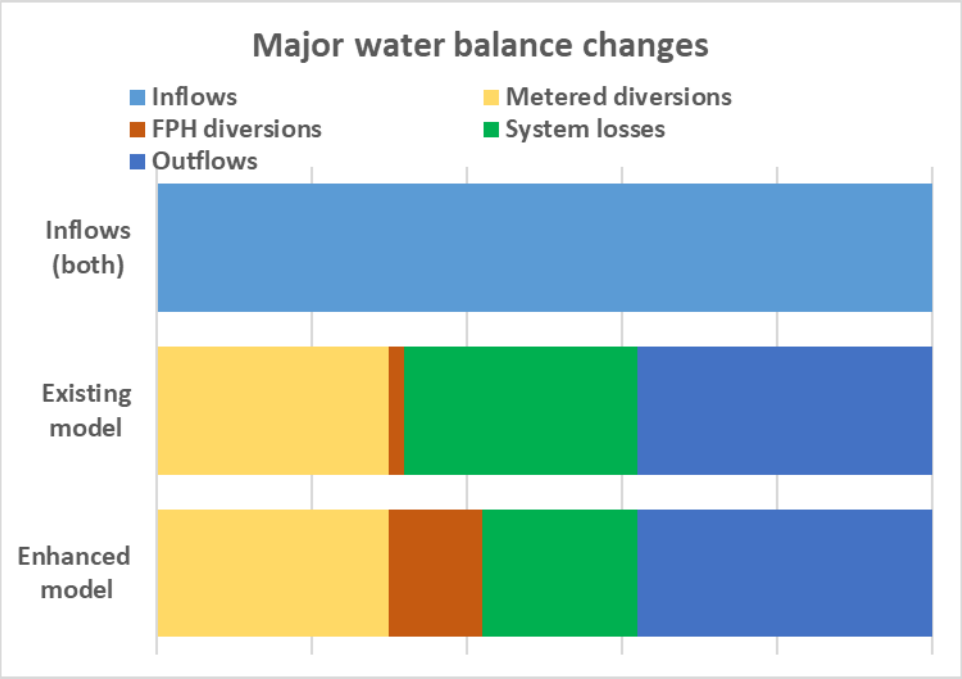


Capability - Quantum



River section – typical detail

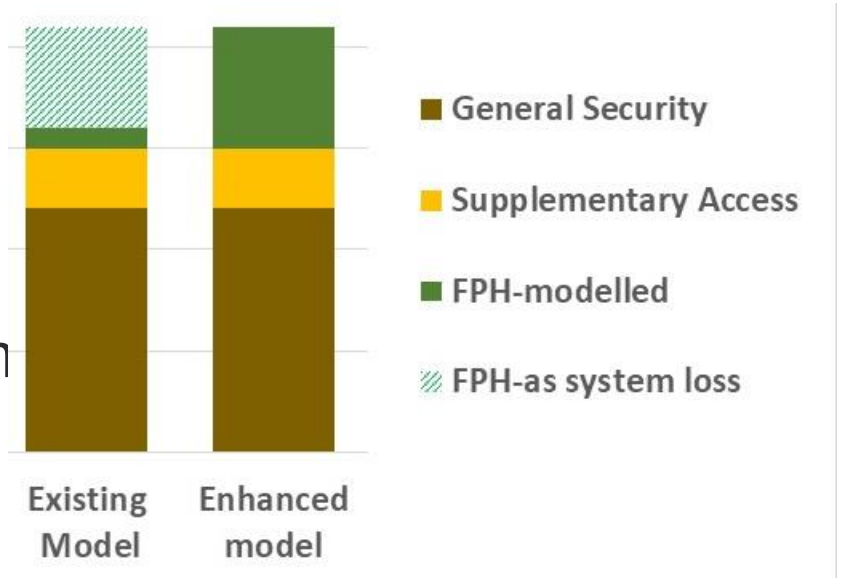
Major water balance changes



- Inflows don’t change
- Metered diversions don’t change
- Flow remaining in rivers does not change
- Previous high system ‘losses’ repartitioned:
  - Lower losses
  - Floodplain harvesting

What this means for Plan Limit

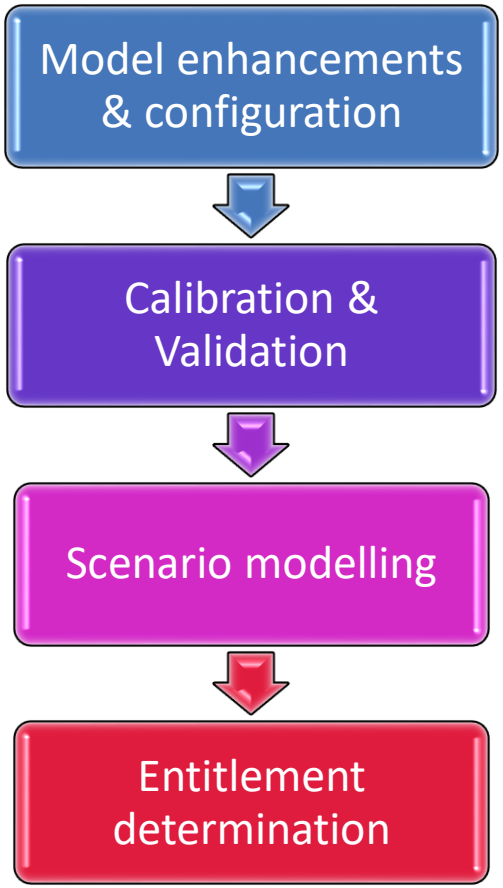
- Plan Limit and BDL are definitions, not numbers
- Model estimates long term average according to definition
- Floodplain harvesting already occurring was underestimated in existing models.
- Enhanced modelling re-estimates this componen
- Plan Limit estimate will change to include this new information.



PART 2

Enhanced model and data

Process for determining FPH entitlements



Key Model Enhancments

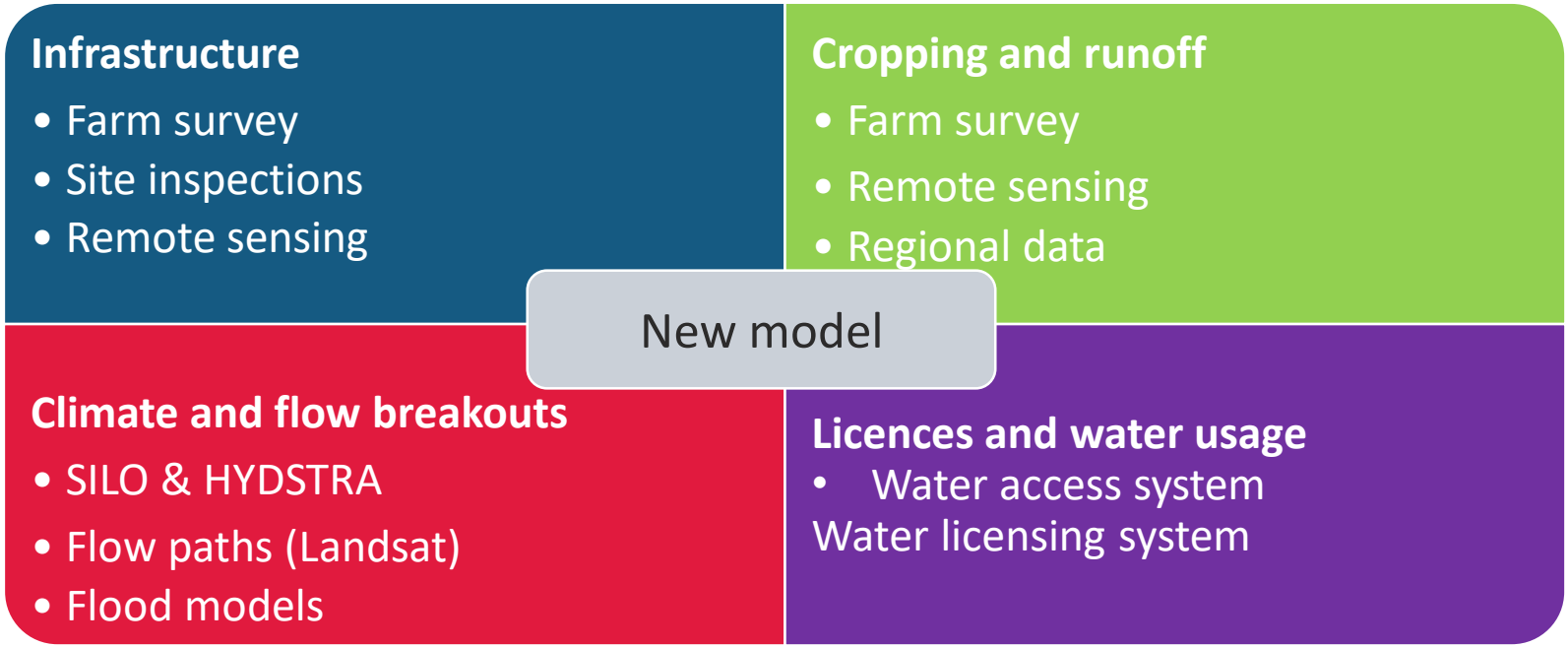
Conceptual

- Individual farms instead of groups
- Explicit flood breakouts, separated from instream losses
- Defined access to breakouts including order
- Separate runoff from developed and non-developed farm areas
- Operation of storages

Others

- More accurate infrastructure details (Farm survey and inspection, remote sensing)
- Complete farm water balance (all water sources)
- Improved representation of various on-farm processes:
  - ✓ Storage and irrigation losses
  - ✓ Separate use of storages
  - ✓ Irrigation application rate

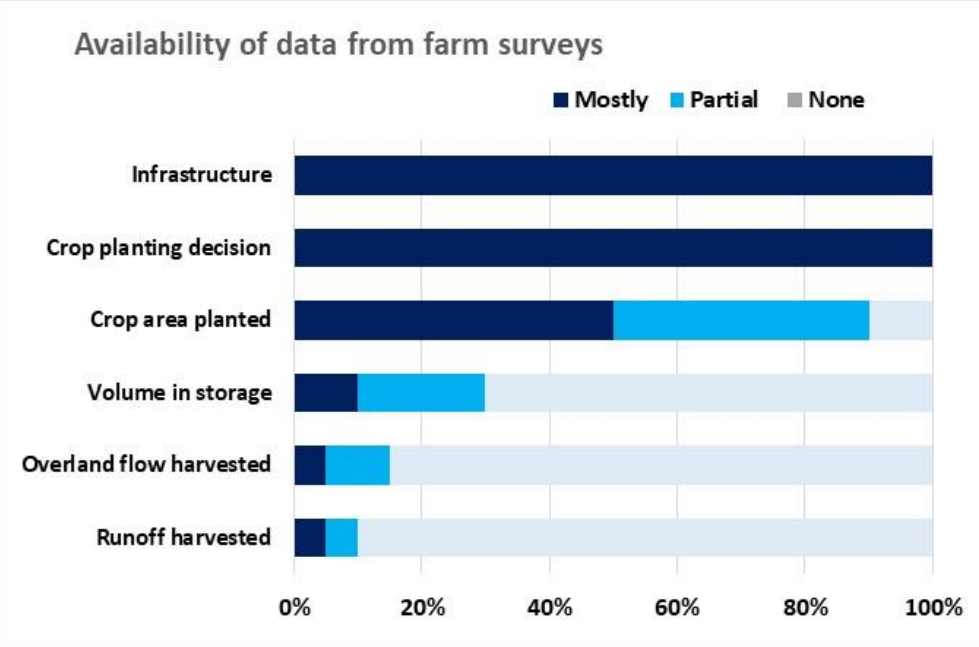
Additional information for models



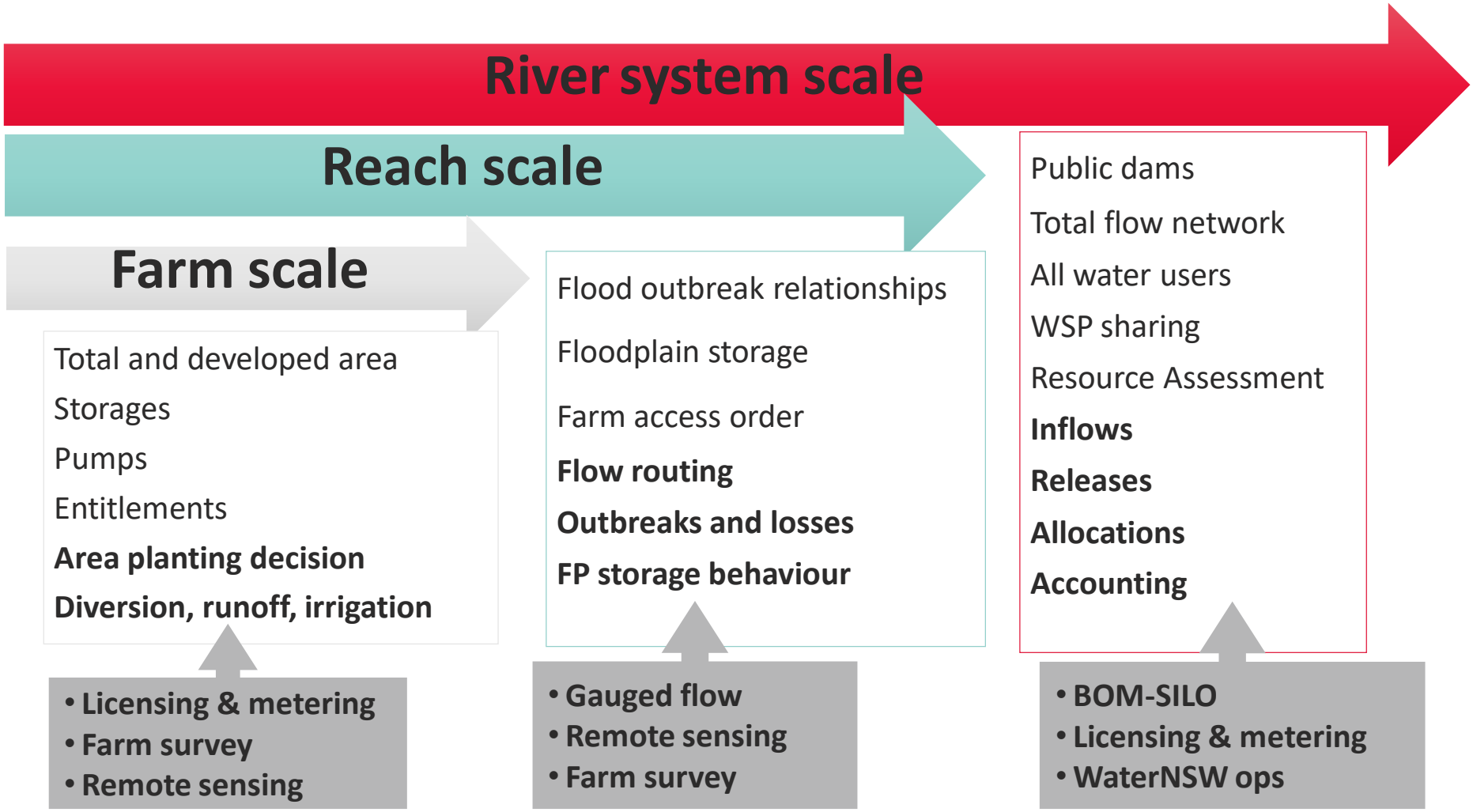
New model

Farm surveys

- Designed to provide information to configure and calibrate models
- Completed by farm and licensing staff
- Completeness
- Verification



Multiple scales of model and process



Water balance critical for credible estimates

Over long term [farm inflows = farm outflows]

Farm inflows:

- General security diversions (GS)
- Supplementary access diversions (SA)
- Floodplain harvesting
  - Overbank flow (OBF)
  - Farm rainfall runoff (RR)

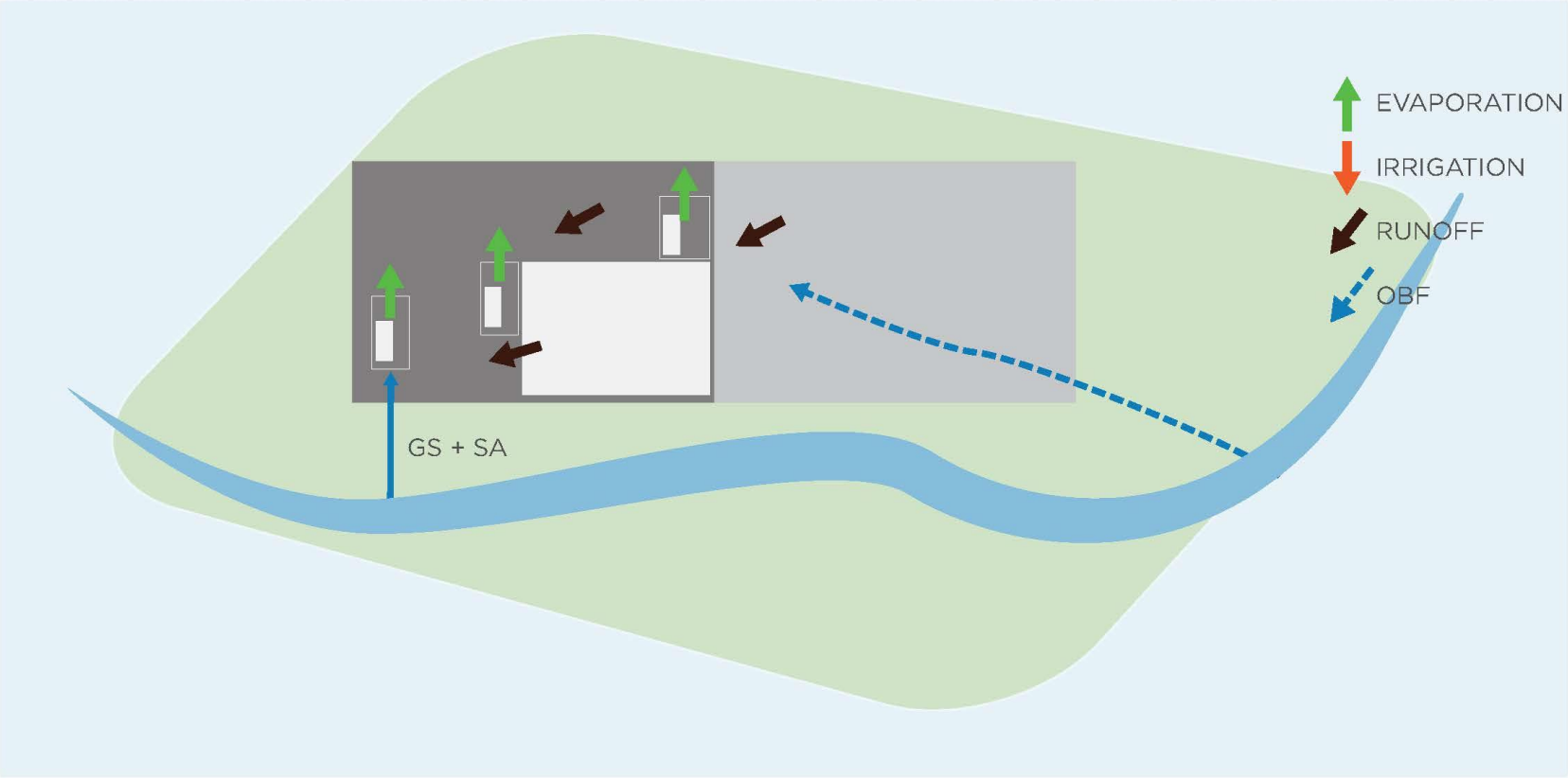
Farm outflows

- Storage net evaporation (EV)
- On-farm losses (FL)
- Irrigation (I)

GS + SA + OBF + RR = EV + FL + I

On farm water balance

On farm water balance



How we reconcile water balance

GS + SA + OBF + RR = EV + FL + I

General security diversions → measured data

Supplementary access diversions → measured data

Rainfall Runoff → modelled to long term average

Overbank flow → ?? Farm surveys, flow analysis

Evaporation → storage modelled from evaporation data and storage surface area

Farm losses → farm surveys and regional averages

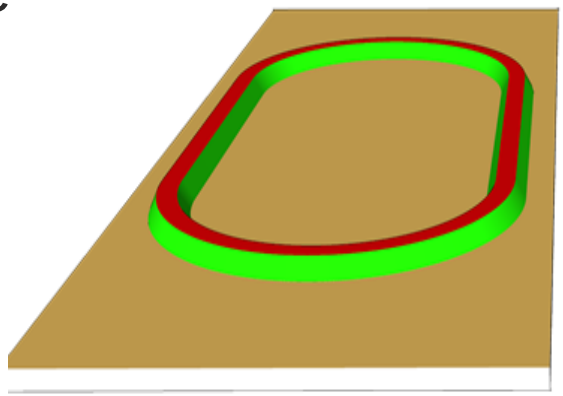
Irrigation → farm surveys crop areas and standard crop demand techniques

- Ultimately – need sufficient inflows to irrigate historical crop areas
- Overbank flow largest unknown

Permanent on-farm storages

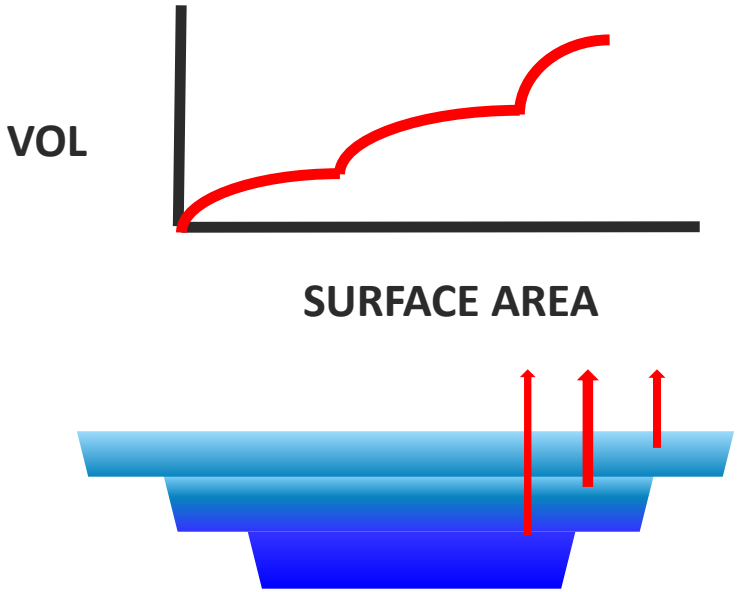
Evaporation
Irrigation
Rainfall runoff
Overbank flow harvesting

- All inflows and outflows through storages
- Farm surveys – range of sources of estimates
- Surveys provided most reliable volume
- LIDAR data collected for floodplain topography analysed and compared to surveyed → accurate
- Surveyed used, else LIDAR
  consistent total volume
- Landsat data (1986→) used to determine date of construction for development scenarios



Storages and evaporation

- All storages represented as single storage and configured to reflect on-farm management

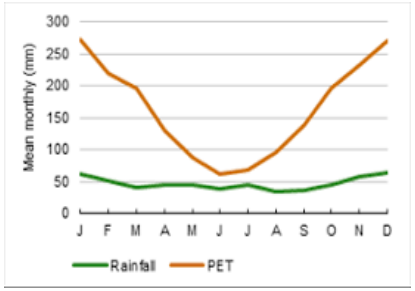


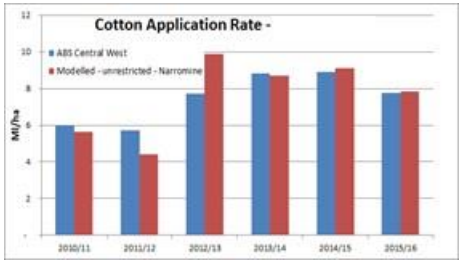
- Composite Volume v Surface Area relationship
- Efficient use of storages to minimise evaporation
- SILO evaporation data acts on surface area➔ **EVAP**

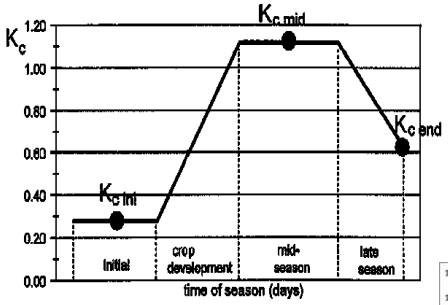
Irrigation

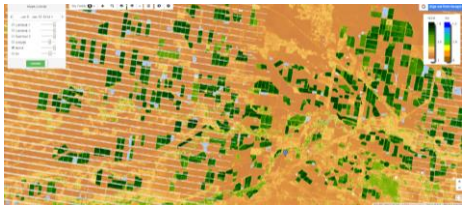
Evaporation
Irrigation
Rainfall runoff
Overbank flow harvesting

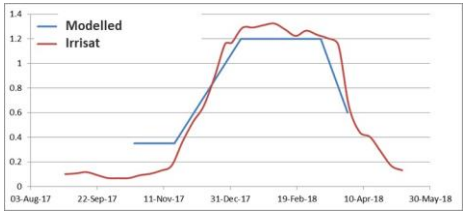
- Crop areas → farm survey verified and infilled by remote sensing
- Application rates → farm survey – wide variation – climate?
- Irrigation demand combination of crop factor and climate (rain, evap)
- Standard techniques used to determine crop factors (FAO56)
- Model application rates compared:
  - Australian Bureau Statistics
  - WaterSched Pro
  - Irrisat







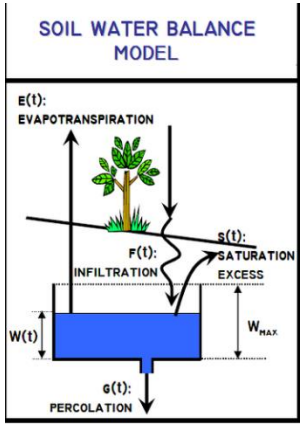


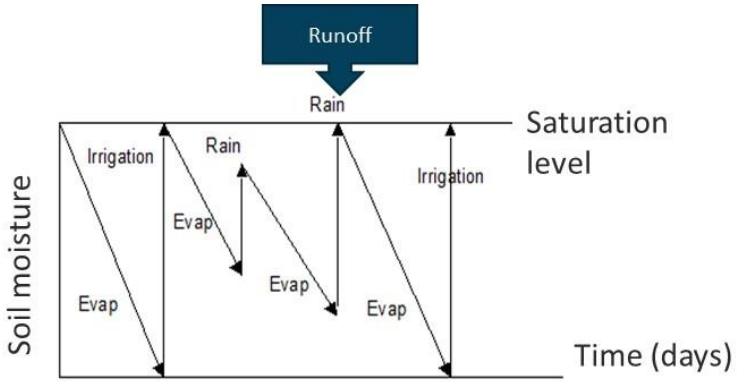


Evaporation
Irrigation
Rainfall runoff
Overbank flow harvesting

Rainfall - Runoff harvesting

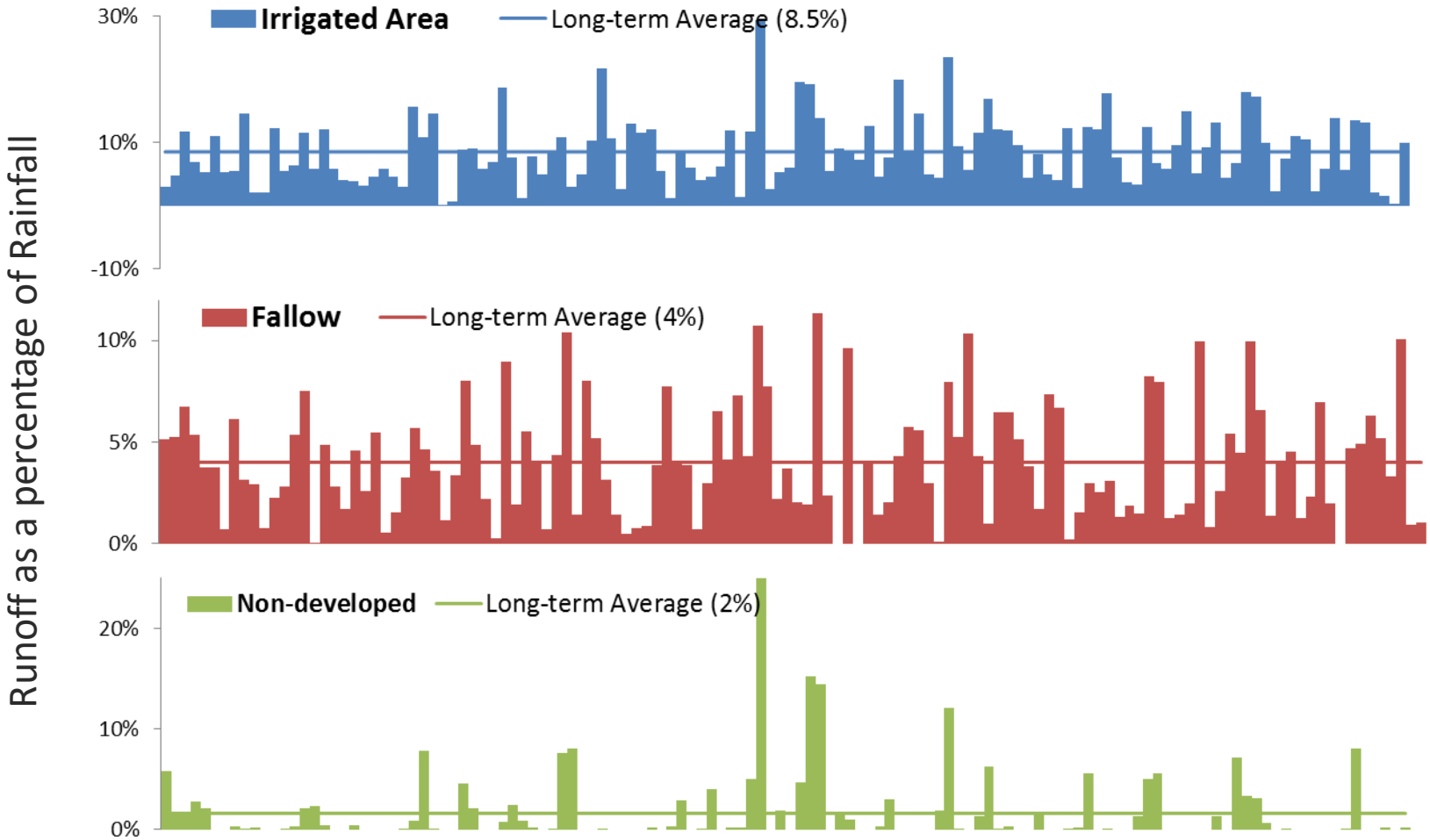
- Daily soil moisture model for each farm – irrigated / fallow / undeveloped
- Increased by irrigation and rain; decreased by evaporation
- Farm survey data incomplete
- Volumes calibrated to long term average runoff coefficients (% of rainfall)
- Regional research, stream gauging





On-farm runoff annual totals

Evaporation
Irrigation
Rainfall runoff
Overbank flow harvesting



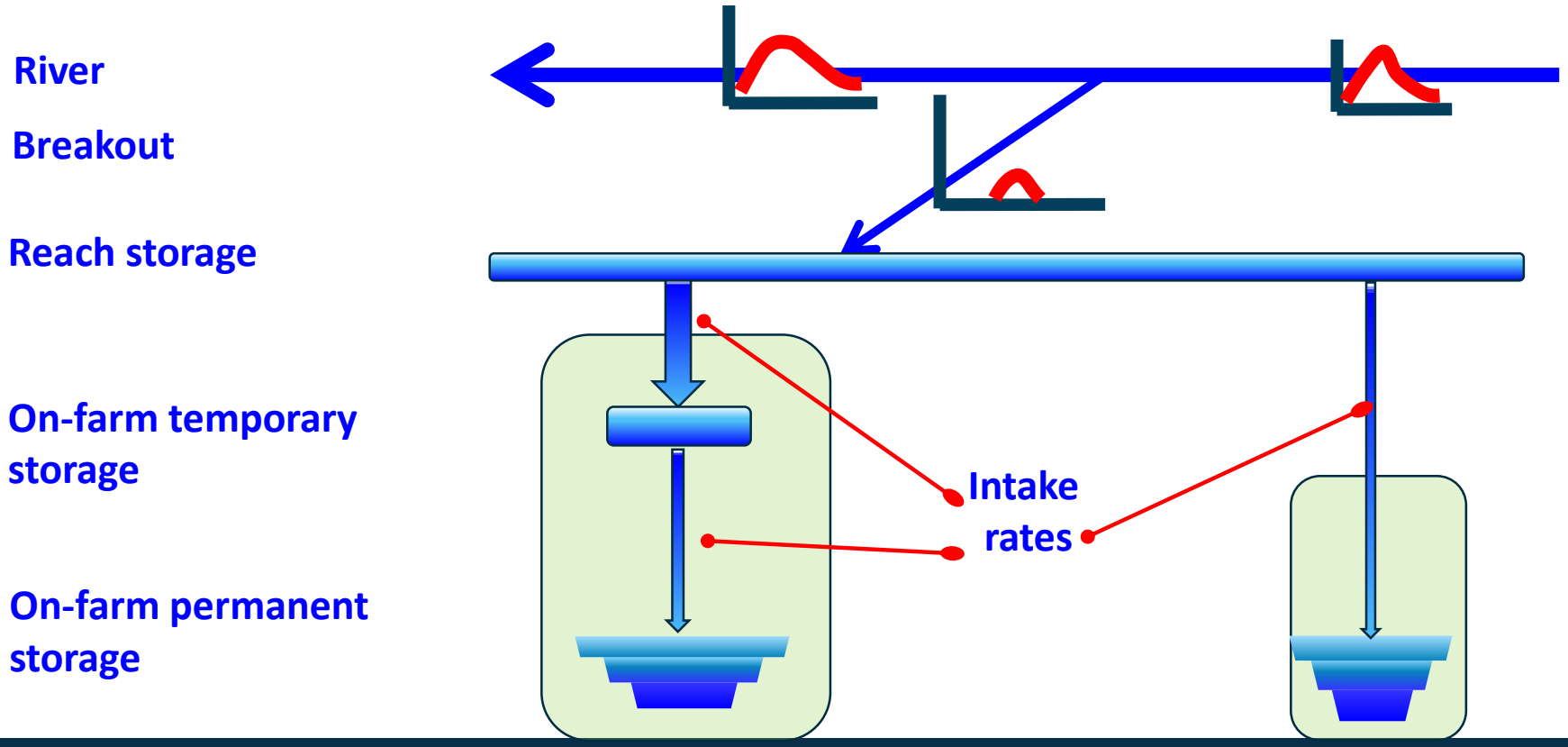
Overbank flow harvesting

Flow breakout processes

- Flow thresholds at locations along a river reach above which where water flows across floodplain
  - Identified by farm surveys and by remote sensing
  - Flow rates nominated in some farm surveys
- Rates at which water leaves:
  - Health Floodplains flood models
  - Flow calibration u/s gauge → d/s gauge
  - River flow v outflow look-up table
- Volume outflow – was system loss → reach storage

Overbank flow harvesting

Use of storages



Temporary storage verification

Evaporation
Irrigation
Rainfall runoff
Overbank flow harvesting

- Work or area on farm that can store overland flow temporarily prior to transfer to a permanent on-farm storage
- Surge areas, sacrifice fields and other facilities where water is stored opportunistically, for up to 2-4 weeks
- Subsequently infiltrates or evaporates (system losses term)
- How to estimate capacity and actual?
- Farm survey consistency, verification by Landsat:
  - Water Observation from Space (WOfS) [% dates 1986→]
  - Targeted image data analysis post overland flow event

Conclusion

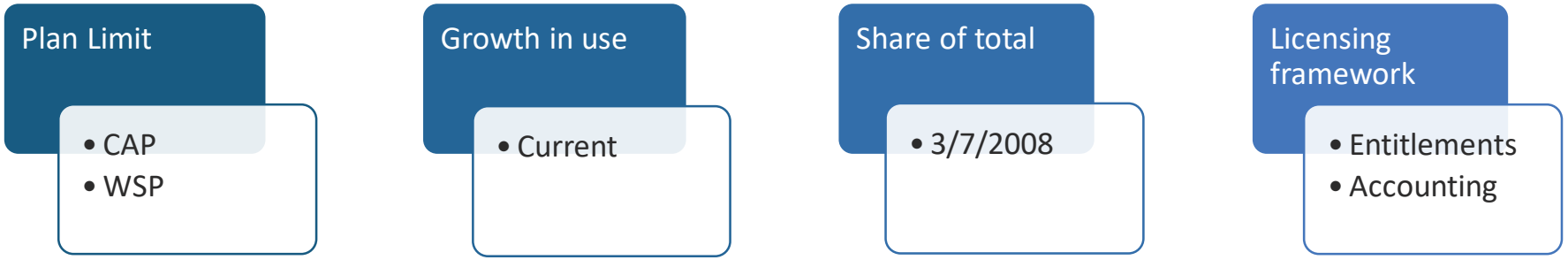
- ✓ Best available data used –published or verifiable data where possible
- ✓ Significant amount of quality checking undertaken
- ✓ A comprehensive, robust model that accounts for varied inputs at a farm scale within a well tested river system model framework

- ? Seeking feedback on assumptions and other relevant published data sources

PART 3

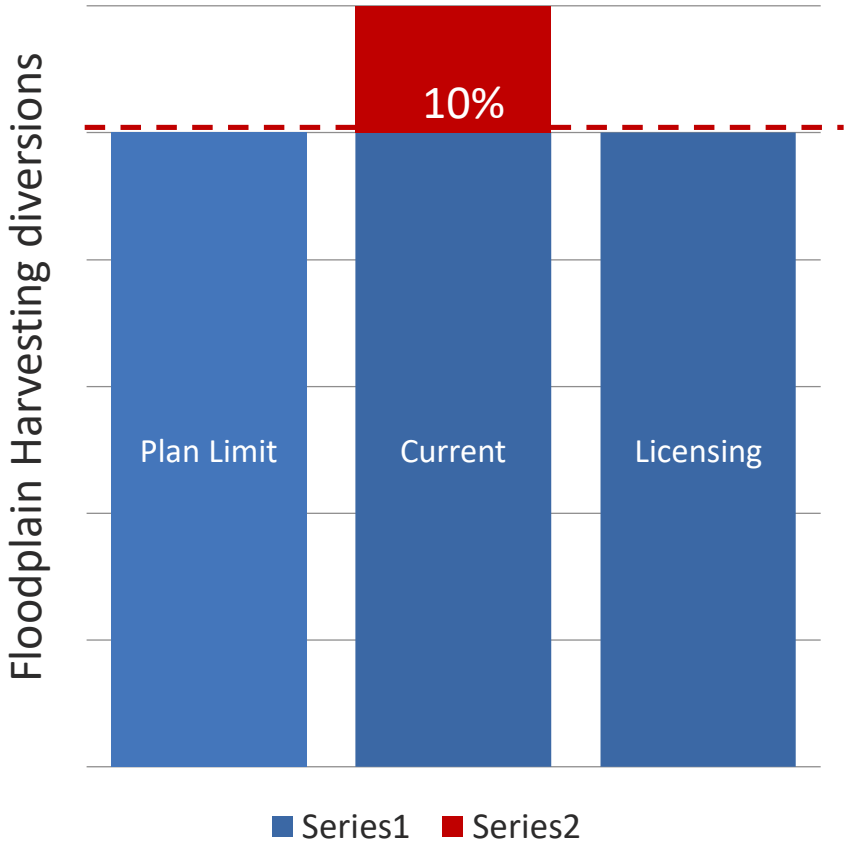
Entitlement determination

Scenarios for entitlement calculation



- Simulated long term average annual diversions (1895-2009)
- Plan Limit → Lesser of re-estimated CAP and Water Sharing Plan
- Current floodplain harvesting diversions determine growth in use
- Share of total floodplain harvesting diversions → 3/7/2008 eligible works
- Entitlements and accounting scale back growth to Plan Limit
- Calculation of entitlements equalises relative individual volumetric impact

Entitlement calculation (example)



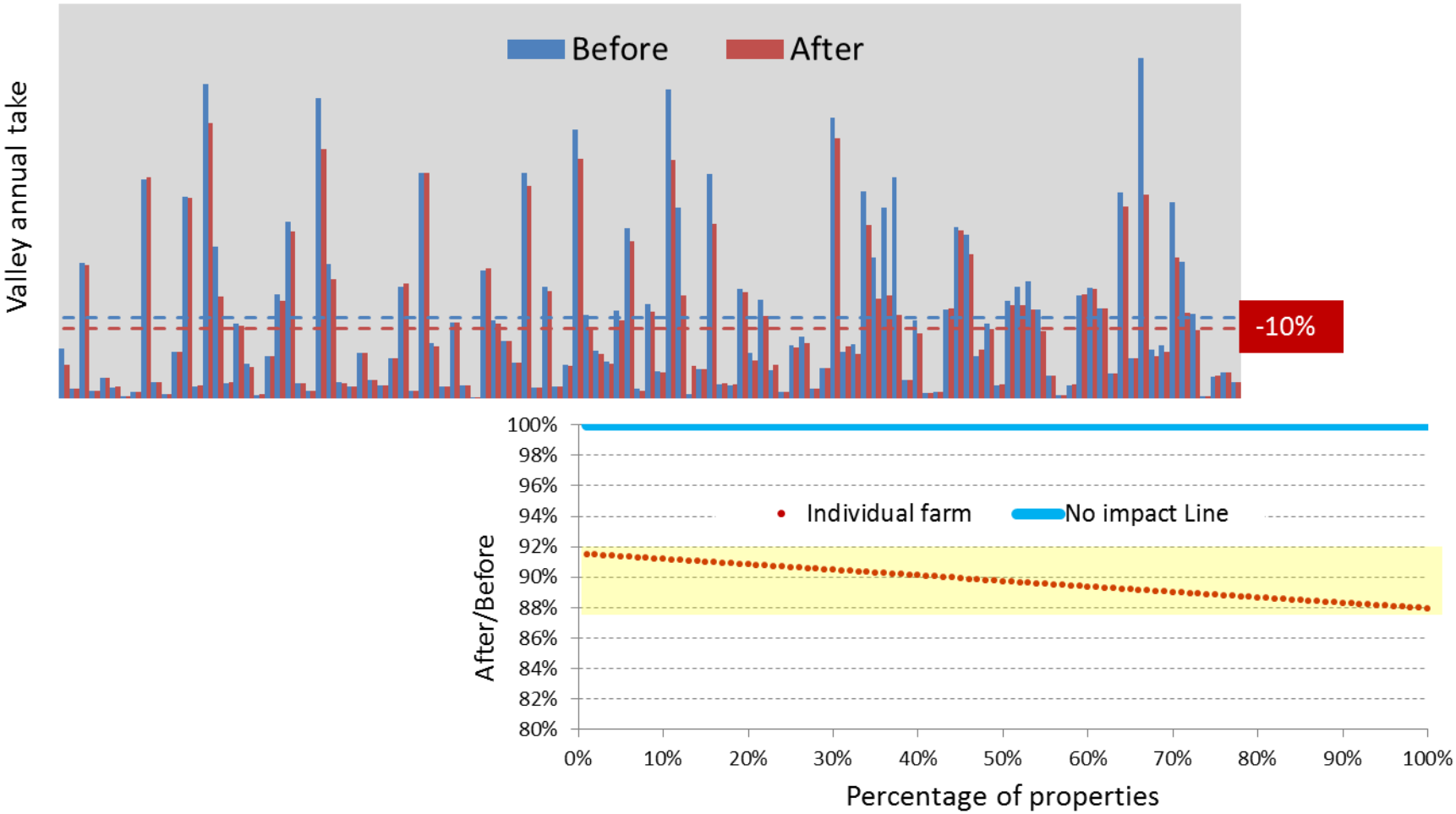
Determine eligible unconstraint individual take

Export annual time series of floodplain harvesting for each farm

Entitlements calculated so that individual impact ≈ 10%

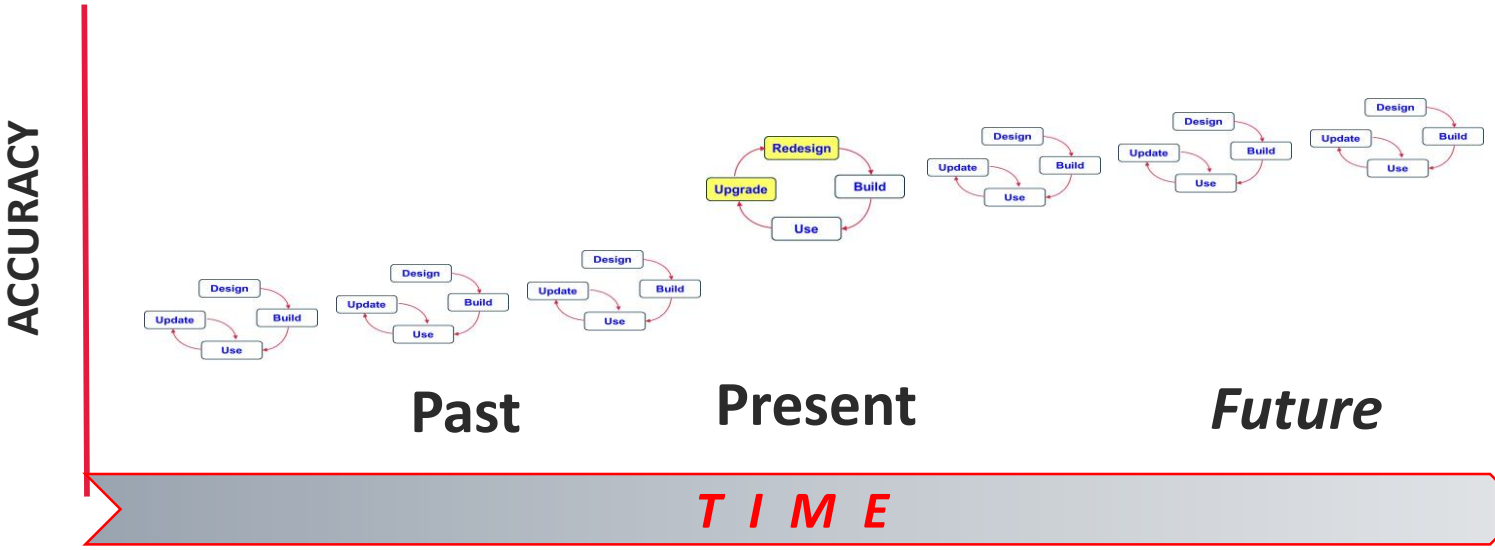
Licensing and rules remove growth, i.e. Current ≈ Plan Limit

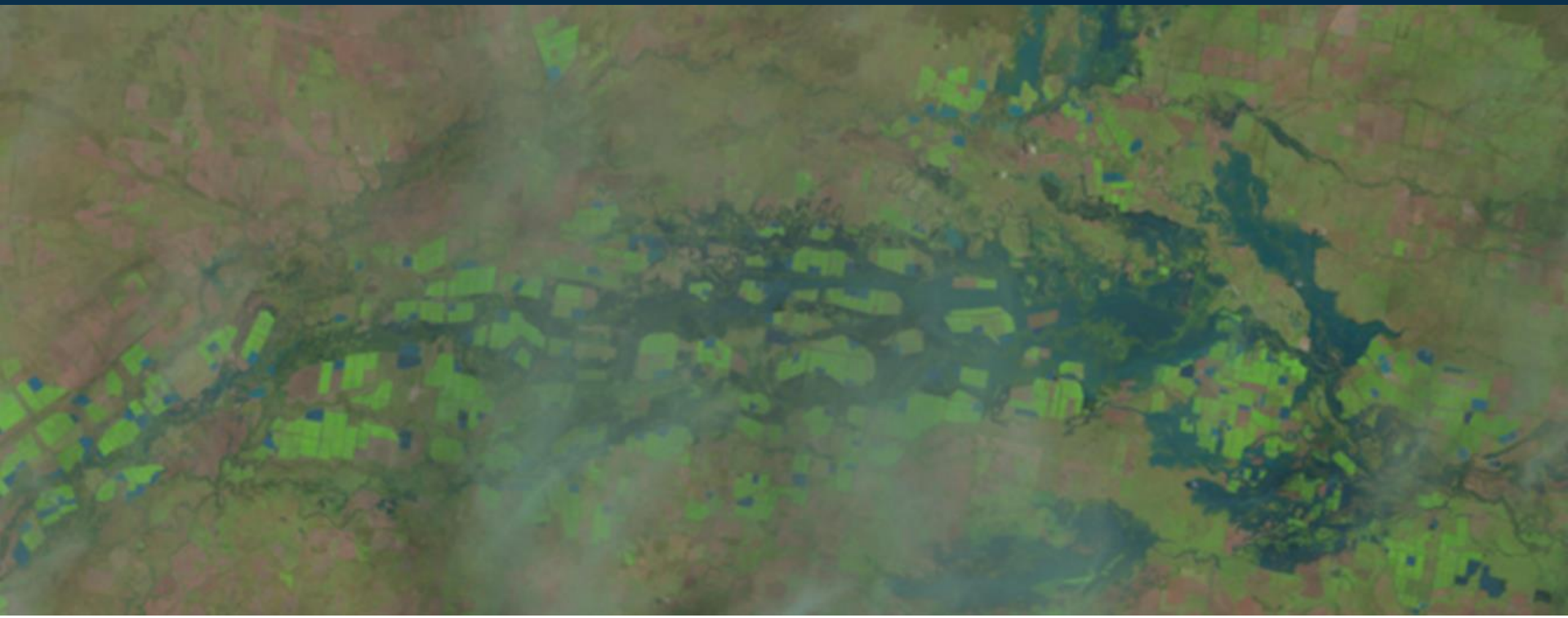
Licensing impact



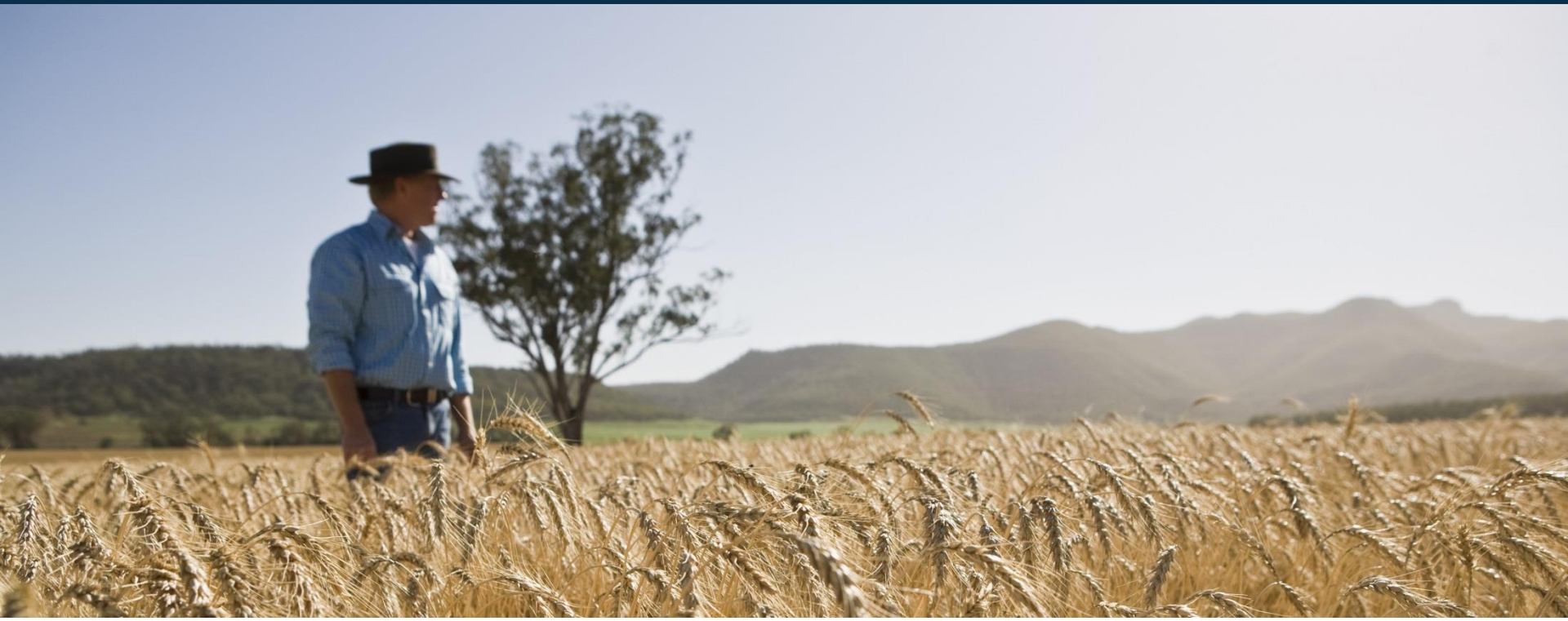
Importance of data & continual improvement

- The more information we have for models, the more accurate our estimates
- We will continue to improve these estimates as more information becomes available





Questions



Floodplain Harvesting Monitoring and Auditing Approach

Nicola Mead – Healthy Floodplains Stage 2 Project Lead

Where we are:

- Currently no monitoring of floodplain harvesting diversions
- Capacity to monitor FPH diversions is one of the significant advantages of bringing these diversions into the licensing framework

Monitoring Approach

- Volumetric measure of take is required
- Propose self-reporting into iWAS
- Initial minimum requirement: gauge boards and storage volume curves
- Sophisticated systems may also be acceptable

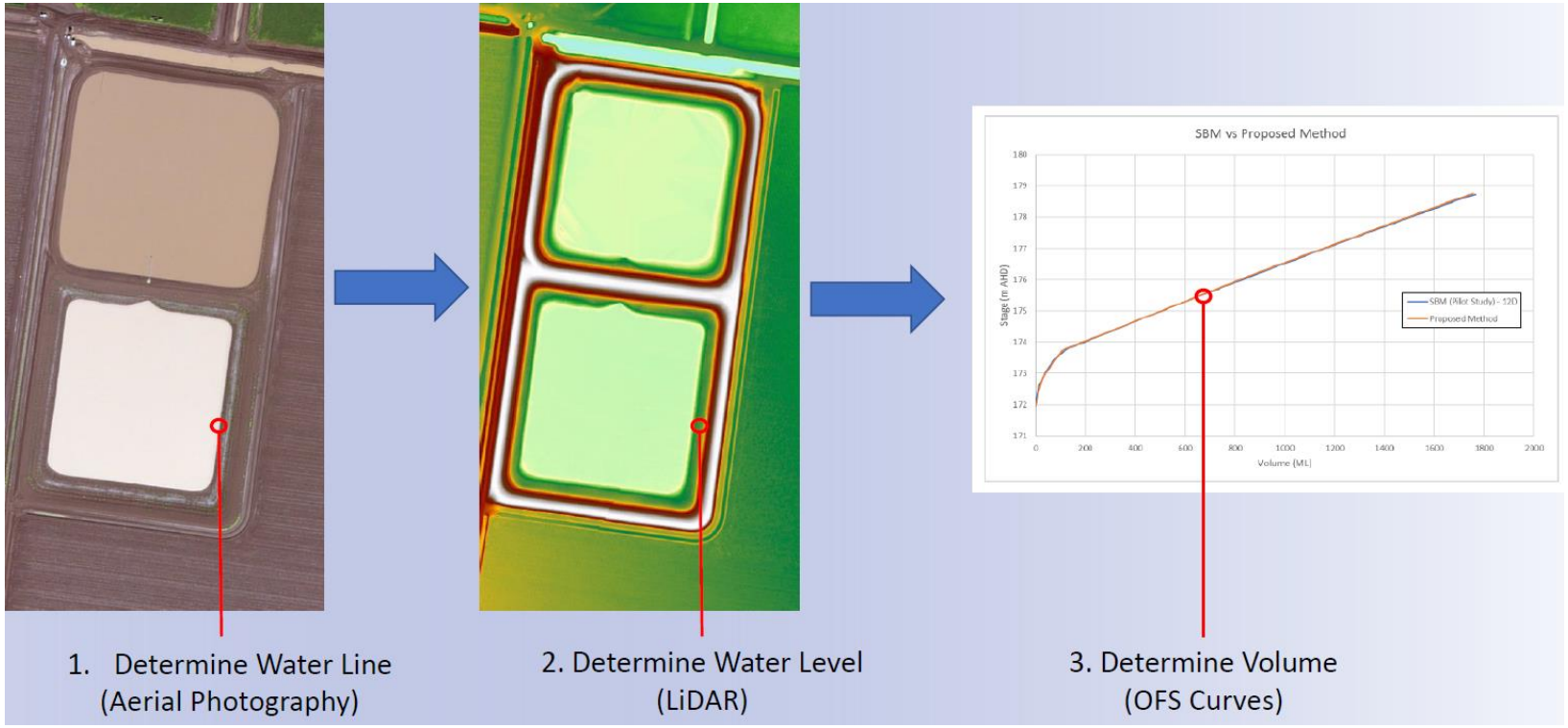
- Verification:
  - NRAR to verify usage against other data sources (imagery, remote sensing etc.)
- Investigation/Auditing:
  - Risk based approach
  - On-ground auditing
- Compliance:
  - NRAR procedures apply

Monitoring approach review

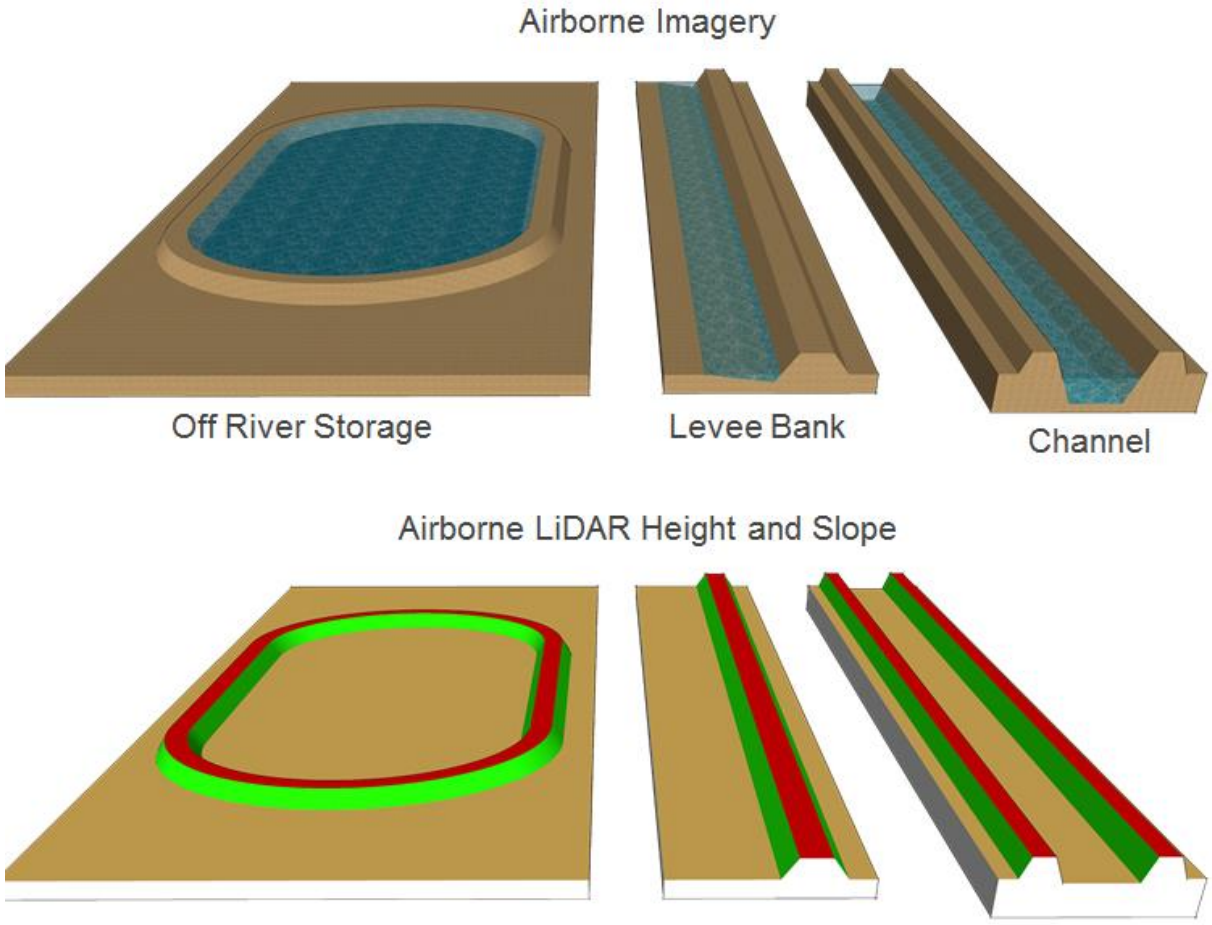
- Approach evaluated in first 2 years
- Revised approach implemented, if required, 3rd year
- Enable transition to new and improved technologies
- Water Pilot Technology Program to assist concepts for innovative technologies

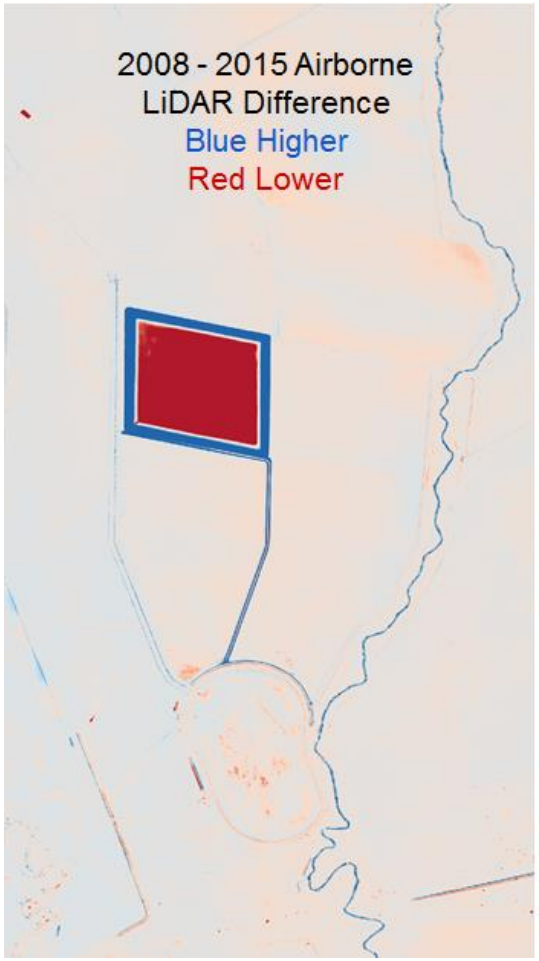
Remote determination of water take: Hydrospatial

- Provide method for determining water take using a water balance approach & remote sensing
- Includes estimation of on farm storage levels



Detecting changes to floodplain structures - UNSW

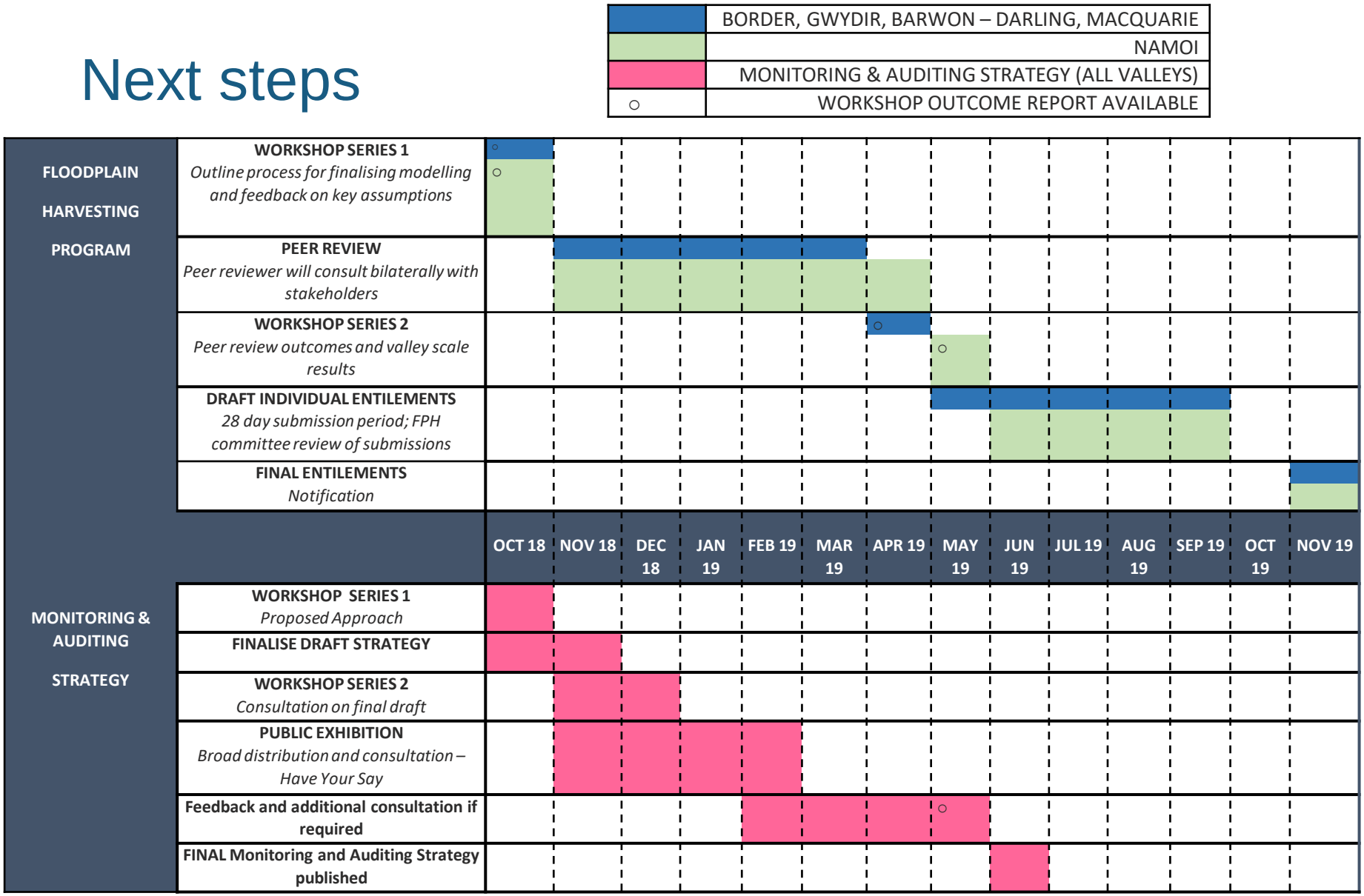




Options for Temporary Storage Monitoring

1. No direct use from temporary storages
   - All take routed through permanent storage
2. Additional measurement devices:
   - Gauge boards
   - Flow meters
   - Pump meter/logs
3. Whole-of-farm water balance:
   - Based on total water use
   - Majority of take will be measured, some will be estimated

Next steps


BORDER, GWYDIR, BARWON – DARLING, MACQUARIE
NAMOI
MONITORING & AUDITING STRATEGY (ALL VALLEYS)
WORKSHOP OUTCOME REPORT AVAILABLE
FLOODPLAIN HARVESTING PROGRAM
WORKSHOP SERIES 1
Outline process for finalising modelling and feedback on key assumptions
PEER REVIEW
Peer reviewer will consult bilaterally with stakeholders
WORKSHOP SERIES 2
Peer review outcomes and valley scale results
DRAFT INDIVIDUAL ENTILEMENTS
28 day submission period; FPH committee review of submissions
FINAL ENTILEMENTS
Notification
OCT 18
NOV 18
DEC 18
JAN 19
FEB 19
MAR 19
APR 19
MAY 19
JUN 19
JUL 19
AUG 19
SEP 19
OCT 19
NOV 19
MONITORING & AUDITING STRATEGY
WORKSHOP SERIES 1
Proposed Approach
FINALISE DRAFT STRATEGY
WORKSHOP SERIES 2
Consultation on final draft
PUBLIC EXHIBITION
Broad distribution and consultation – Have Your Say
Feedback and additional consultation if required
FINAL Monitoring and Auditing Strategy published

Thank you for your contribution

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