Development of Phase 6 Model Land Use Export Rate Targets

Water Quality Goal Implementation Team

April 16, 2015

Olivia Devereux

Export Rates and Targets

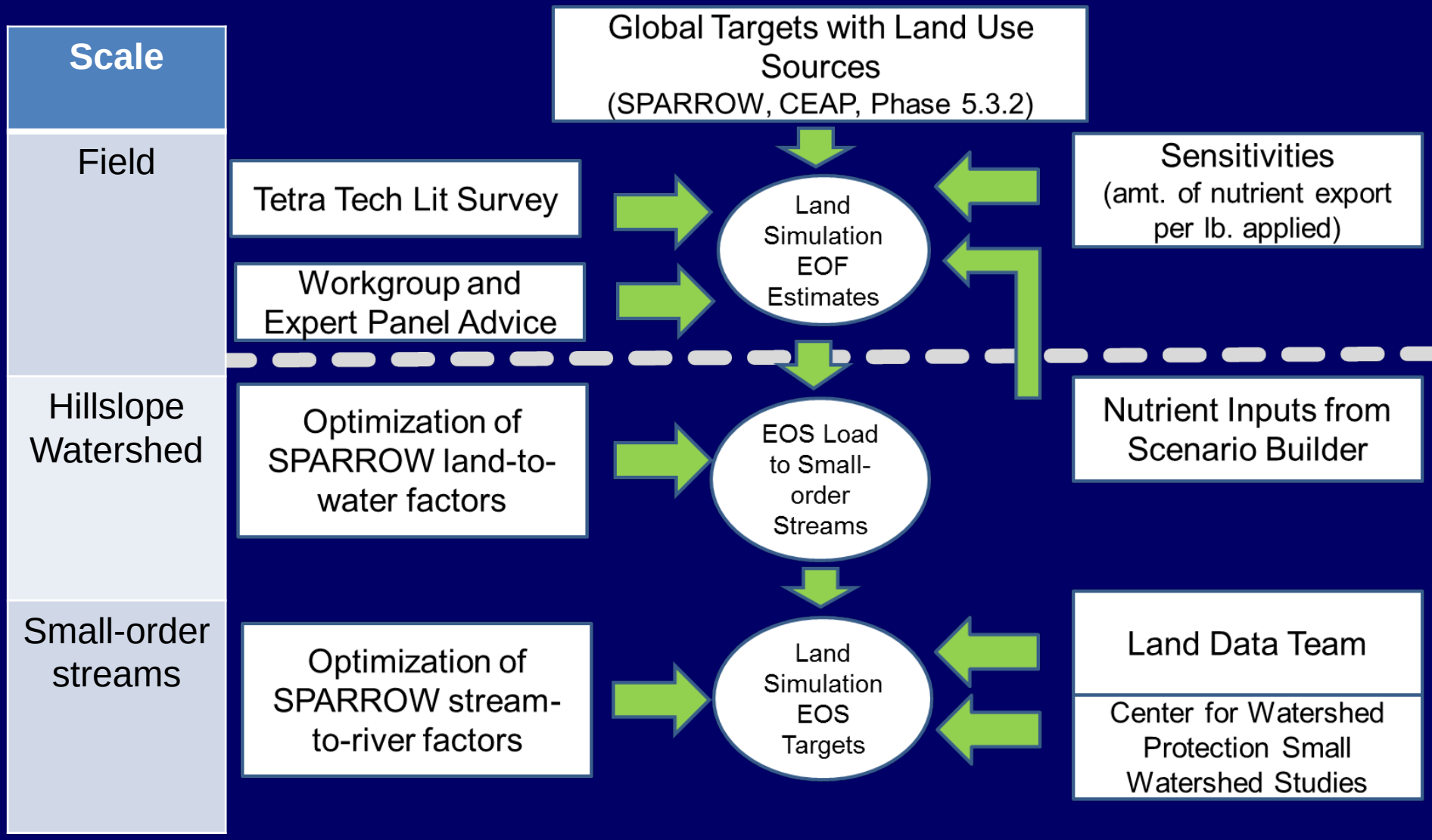
- Export rates from multiple models and literature are used to inform the targets.

- Targets are a type of export rate used to calibrate the Phase 6 Watershed Model.

Calibration Targets

- For each species of nitrogen, phosphorus and sediment.
- Long-term annual, not one for each year. Annual variation comes through hydrology and nutrient inputs.
- Order the influence of different land uses.
- Vary geographically based on nutrient and hydrology inputs.
- Do not include BMPs.
- Subject to modification through calibration: actual rate adjusted while relative differences maintained.

Land Simulation Development



Method of Applying Sensitivities

- Shows us the differences in nutrient export relative to nutrient input.
- Land segment lb/A =
  target + ∑ ((lseg input rate–median input for CBWS) * sensitivity)
- Sensitivities are determined from the Phase 5.3.2 WSM.
- Updated sensitivities are being incorporated into the final targets.

Reviews of Scientific Literature and local TMDLs: Developed, Natural and Agricultural Land Uses

TETRA TECH

MEMO

To:	Gary Shenk, EPA; Peter Claggett,
Cc:	Tom Schueler, CSN
From:	Mark Sievers, Tetra Tech Inc.
Date:	March 31, 2014
Subject:	Land Use Loading Literature Revie

The memo is separated into the following secti

PRELIMINARY DRAFT

Agricultural and Forest Land Use Loading Rate Literature Review—Summary and Results

January 13, 2015

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Available on line on the Midpoint Assessment Website

https://www.chesapeakebay.net/about/wmp_for_mpa_effort/land_use_load_literature_reviews

(or Google “CBP midpoint assessment literature review”)

Role of Workgroups

Chesapeake Bay Program committees, goal implementation teams, workgroups, and action teams	Meeting Date
Modeling Workgroup	9/30/2014, 1/29/2015, 3/26/2015, 4/22/2015
Modeling Team	9/15/2014, 1/20/2015, ongoing weekly
Water Quality Goal Implementation Team	4/13/2015, 5/11/2015
Land Use Workgroup	9/25/2014; 2/26/2015
Watershed Technical Workgroup	10/2/2014, 3/5/2015
Forestry Workgroup	10/1/2014, 3/4/2015, 3/20/2015
Wetlands Expert Panel	11/12/2014
Urban Stormwater Workgroup	10/21/2014, 12/16/2014, 3/3/2015
Agricultural Workgroup	10/9/2014, 10/22/2014, 2/19/2015, 3/18-19/2015, 4/16/2015
Agricultural Modeling Subcommittee	9/16/2014,12/16/2014, 2/12/2015, 2/18/2015
Agricultural Loading Rate Review Subgroup	3/25/2015

Phase 6 Draft Land Uses—Developed

All are also divided by federal, MS4-regulated, and Combined Stormwater Sewer (CSS)

- Impervious
  - Roads
  - Buildings, parking lots, etc.
- Pervious Turf
- Urban Tree canopy
- Construction
- Abandoned/Reclaimed Mines – newly proposed
- Active Mines – newly proposed

Phase 6 Draft Land Uses—Natural

- Forests
  - True Forest
  - Harvested
  - Disturbed (e.g.: insect, fire)
- Water
- Wetlands
  - *Tidal emergent ?*
  - *Fresh emergent ?*
  - *Non-tidal woody ?*
- Open Space

Wetlands Expert Panel making progress, but not yet finished determining land uses

Phase 6 Land Uses—Agricultural

Approved by the Ag Workgroup 3/18/2015

- Corn or sorghum grain – w/ and w/o manure
- Corn or sorghum silage - w/ and w/o manure
- Sm gr & soybean – no manure
- Full season soybean – no manure
- Sm gr & grain - elig. for manure

- Other Agronomic crops
- Specialty - high input
- Specialty - Low input

- Pasture – direct dep; elig. for manure
- Legume (or legume-grass mix) Hay
- Other Hay

- Ag open space

- Non-permitted feeding operation space
- Permitted (or NOI) feeding operation space

- *Impervious farmstead*
- *Pervious farmstead*

Legume and Manure Differences

- Address through AgChem sensitivities and variations in nutrient application, in addition to the limited data from the literature review.
  - Legume and non-legume pasture.
  - Manured vs. non-manured.

- For manured, Ag Census provides percent of crops receiving manure.
  - Need to determine a valid method to project the ratio of manure eligible to non-manured crops.

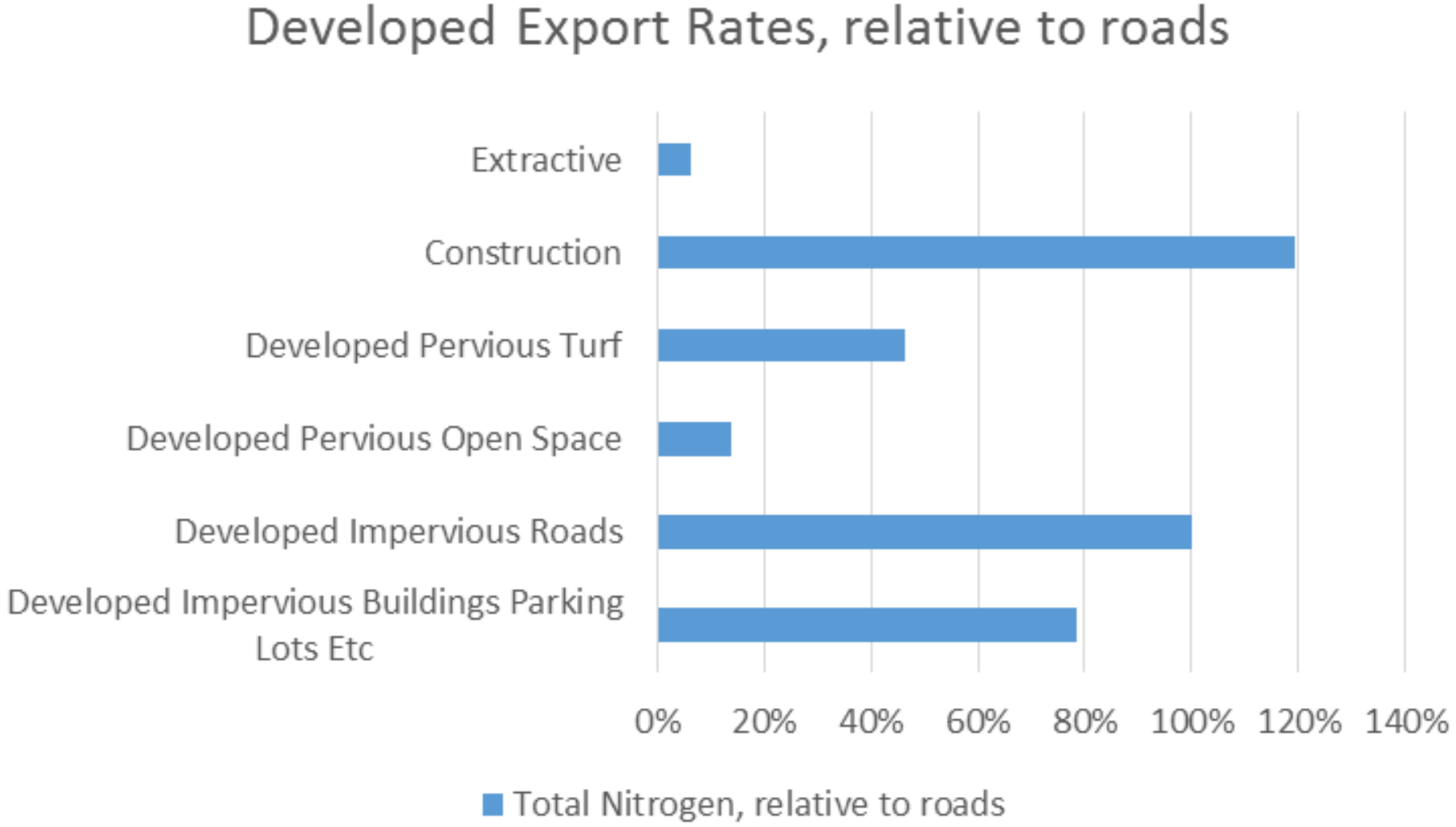
Source Sector Workgroup Activities In Process

- Developed
  - Urban Tree Canopy—iTree Hydro Model and Expert Panel
  - Extractive land use—abandoned/reclaimed and active are under consideration
- Wetland Literature Review (conducted in conjunction with the Wetland Expert Panel)
  - Review for wetland efficiency
  - Potential wetland land uses
  - Review for loading rates
- Agriculture
  - New Relative Loading Rate Review Subgroup of the Agricultural Modeling Subcommittee
  - “Grey” Literature collected by Water Stewardship under a CBW-ROC grant

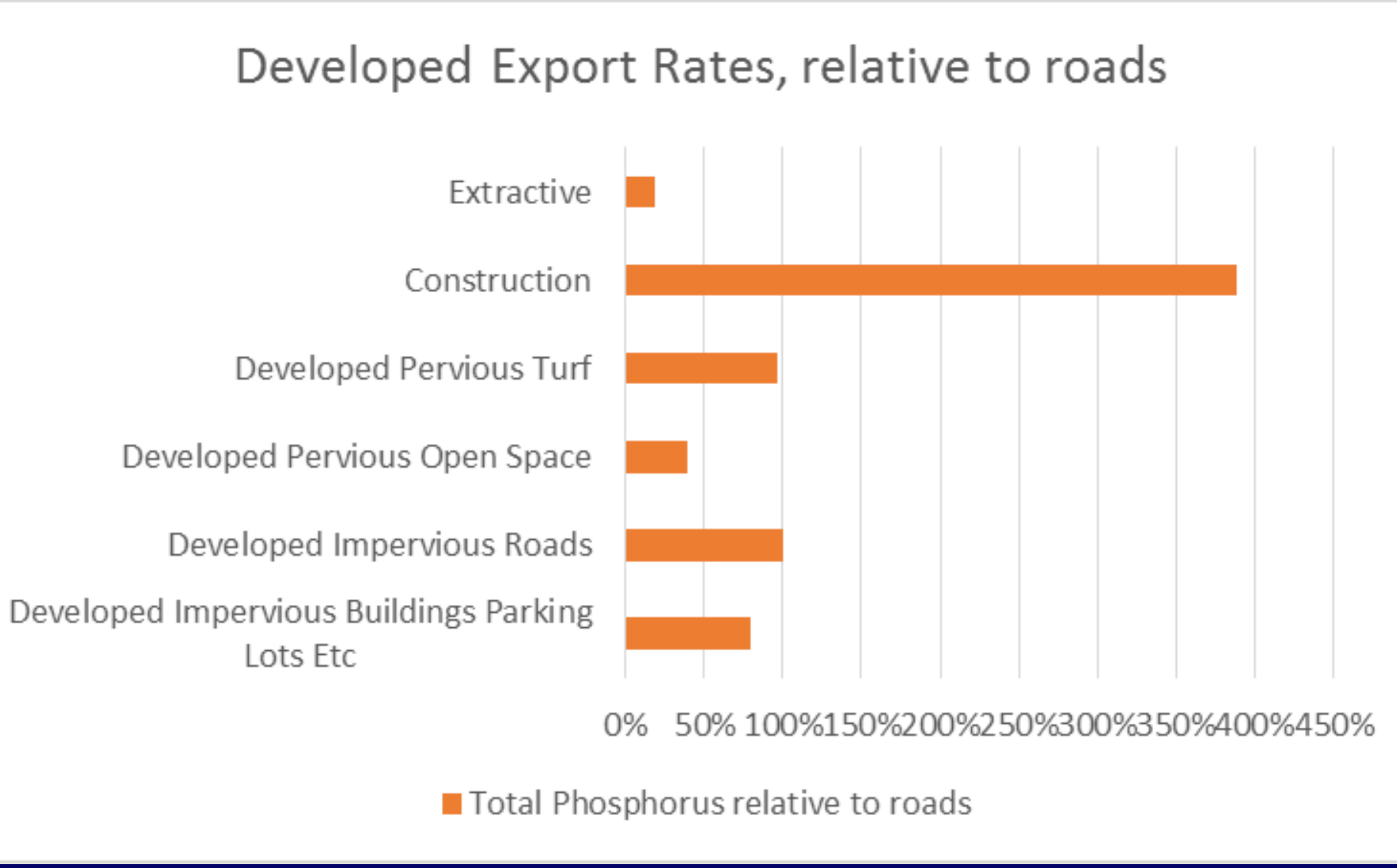
Status

Sector	Land Uses	Targets Complete	Targets TBD	Percent of Total Land Uses
Developed	7	4	3	23%
Natural	6	5	1	19%
Agricultural	18	0	18	58%
Total	31	8	23	
Percent complete		***29%***		

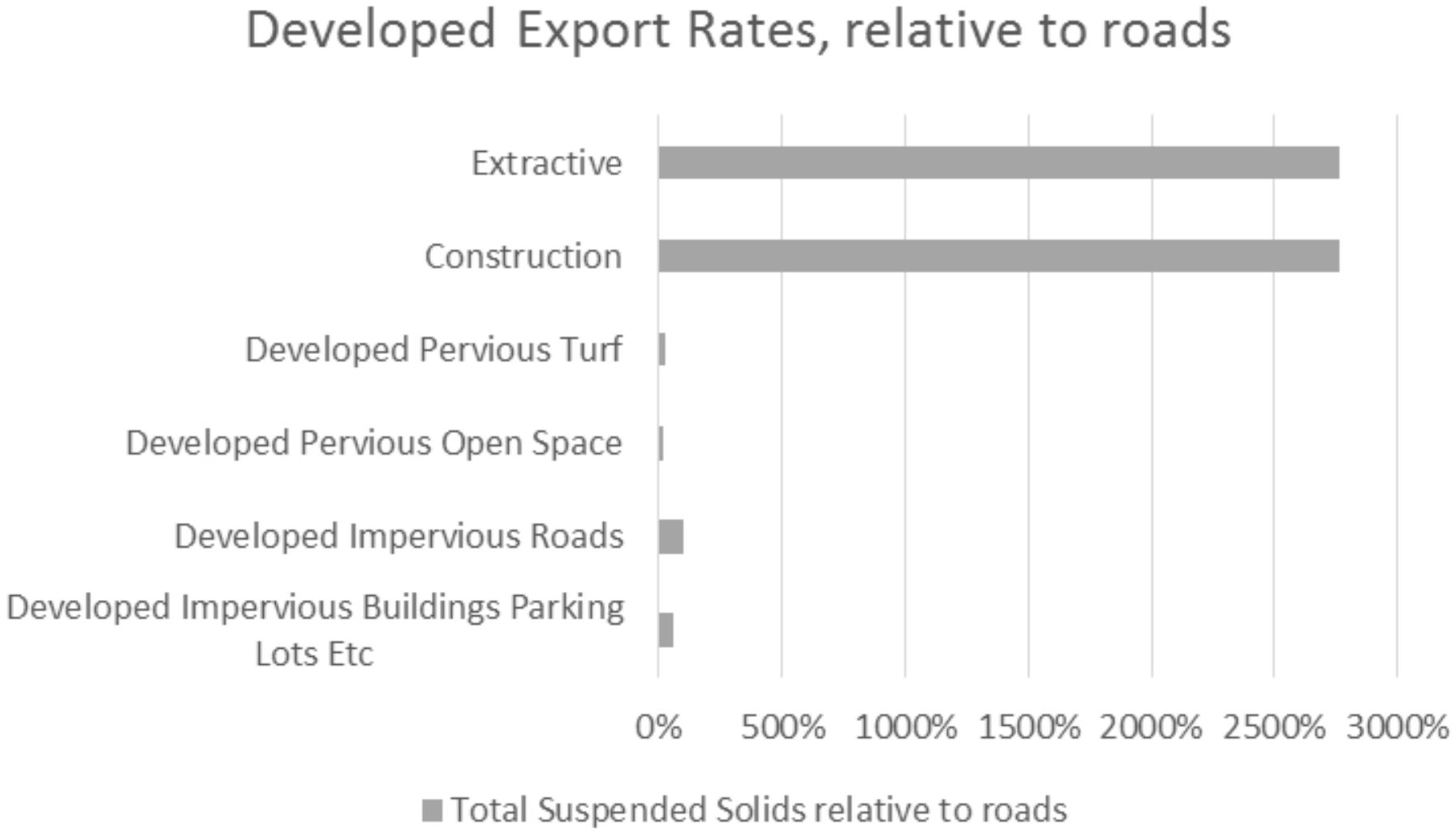
Developed TN Relative Rates



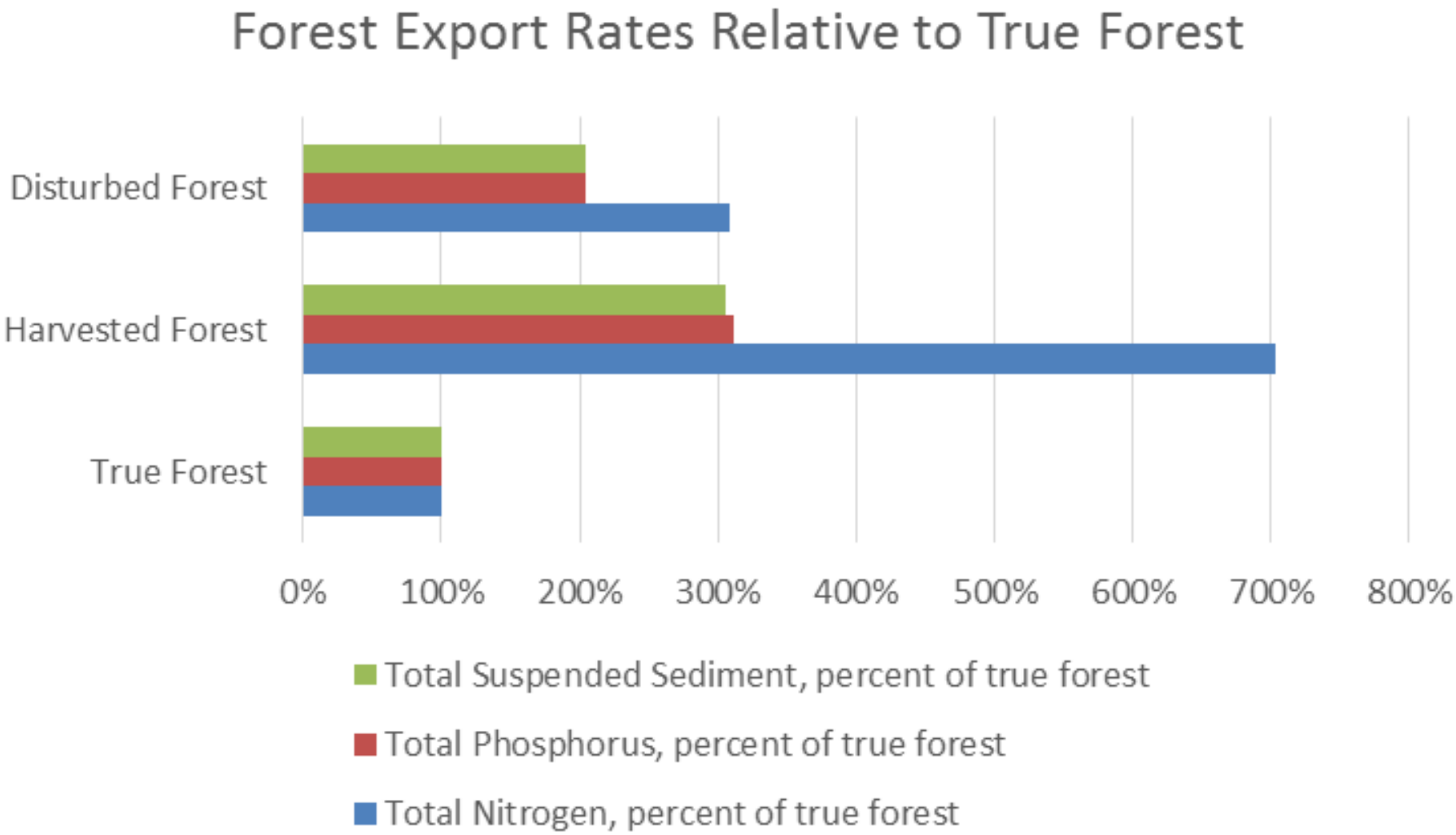
Developed TP Relative Rates



Developed TSS Relative Rates



Forest TN, TP, TSS Relative Rates



Agriculture Relative Rates

- To be determined by the Agriculture Loading Rate Review Subgroup

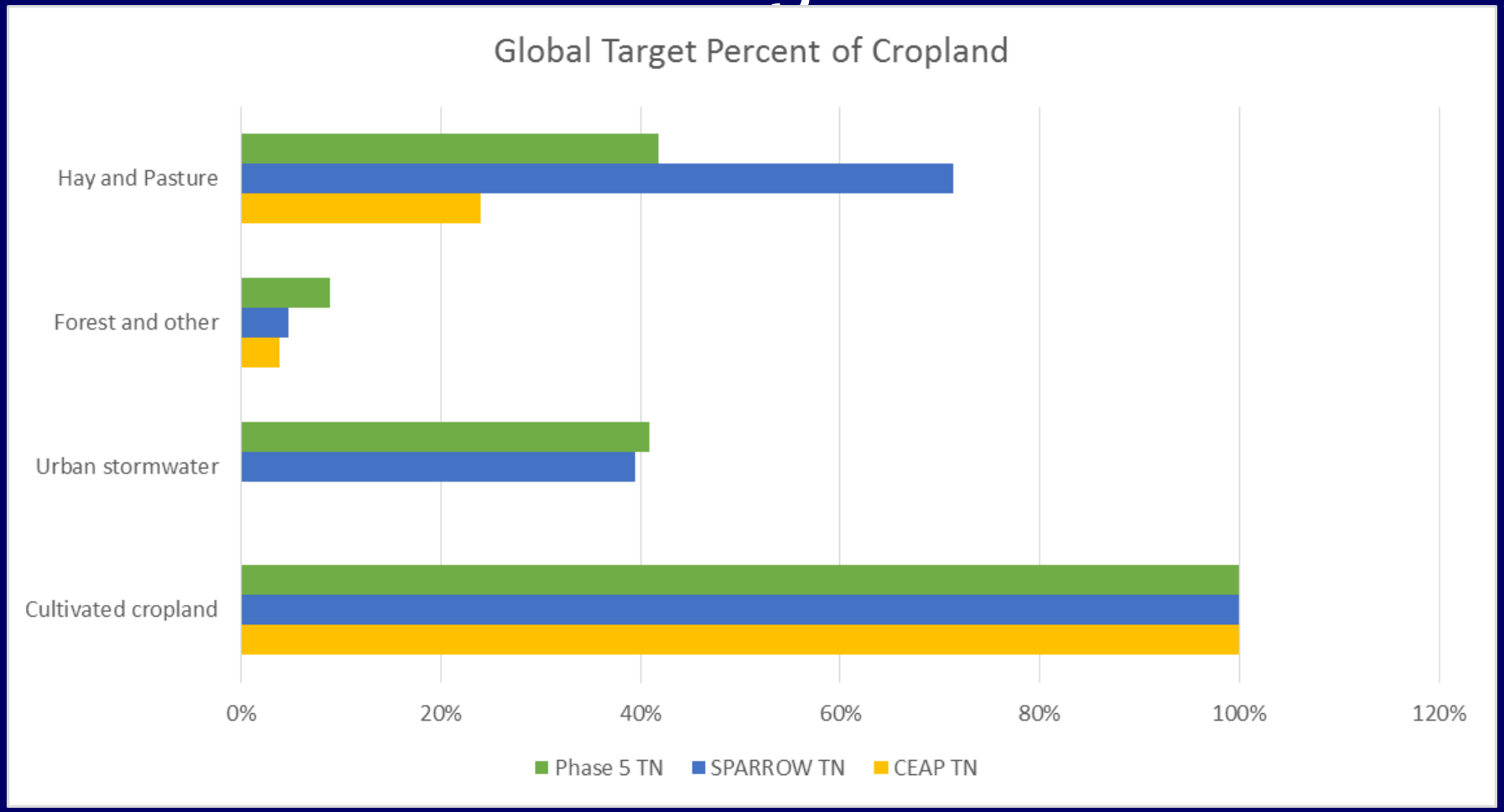
Scaling across Sectors Using Global Targets

- Incorporates multiple models.
- Determine relative difference among literature review targets within each global target category (e.g., crop, pasture and hay, urban stormwater, forest).
- Weight by acres of each land use so each target within the global land use category sums to the global target total pounds.

Developing Global Targets

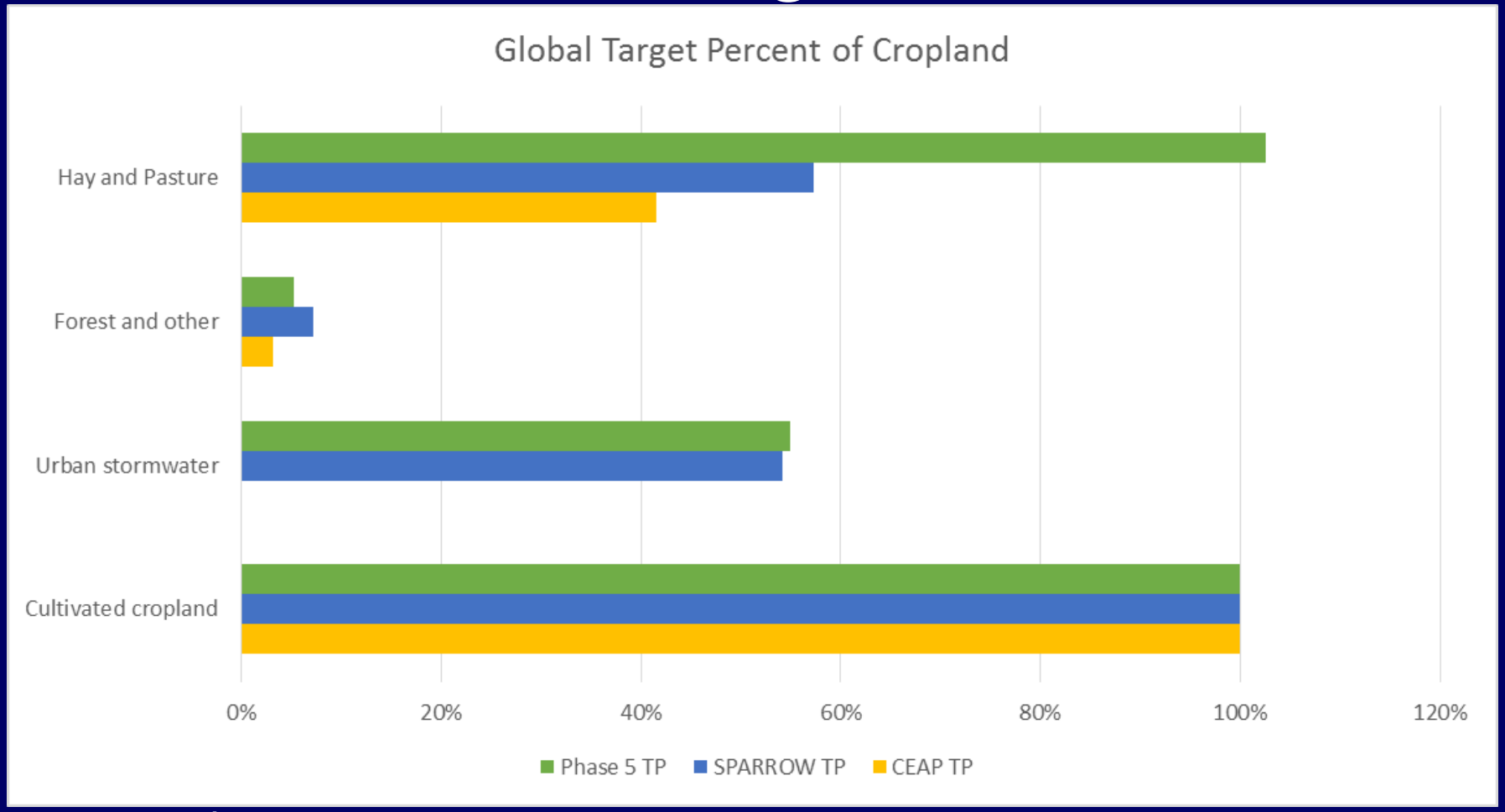
- SPARROW's strengths are indicating the differences among land use categories.
  - When SPARROW is run with land uses as the regression parameters, then the regression coefficients are equivalent to export rates at an edge of small stream scale.
  - Remove BMP effects by applying percent change between WSM 2002 Cal Yr. and No Action to SPARROW loads.
    - 2002 Cal Yr will be updated once BMP history is revised.
- CEAP 2013 Average annual loads delivered to watershed outlets (8-digit HUCs) for no-practice scenario—*Not using for urban.*
- Phase 5.3.2 Targets.

Global Targets—TN



Range and Average:
Hay/Pas = 10 to 20 lb/acre; Average = 16 lb/acre
Forest = 1.3 to 4.2 lb/acre; Average = 2.4 lb/acre
Stormwater = 11 to 19 lb/acre; Average = 15 lb/acre
Cropland = 27 to 48 lb/acre; Average = 39 lb/acre

Global Targets—TP



Range and Average:
Hay/Pas = 0.56 to 2.3 lb/acre; Average = 1.4 lb/acre
Forest = 0.07 to 0.12 lb/acre; Average = 0.10 lb/acre
Stormwater = 0.53 to 1.2 lb/acre; Average = 0.88 lb/acre
Cropland = 0.99 to 3.1 lb/acre; Average = 2.1 lb/acre

Example of Global Target Use

Hypothetical Data