August 28, 2023

NORTH PLATTE RIVER CHOKEPOINT

ANDERSON CONSULTING ENGINEERS, INC.
RIVER WORKS, LTD

NORTH PLATTE CHOKEPOINT
AUGUST 28, 2023
MEETING OVERVIEW

- Purpose: Review and Discuss Chokepoint Alternatives
- Chokepoint Project Overview – Seth Turner
- Presentation of Chokepoint Alternatives – Anderson Consulting Team
- Discussion and Feedback from Workgroup
  - Full List of Alternatives
  - Short List of Alternatives
  - Alternatives Screening and Analysis

PROJECT CHARTER

Project Goal

Identify and screen alternative solutions to increase hydraulic capacity through the chokepoint and/or provide delivery of flows downstream of the chokepoint through other systems.

Project Objectives

1. Identify, screen, and rank past and potential new alternatives
2. Update and calibrate baseline models.
3. Conduct detailed hydraulic and/or sediment transport modeling as needed
4. Complete assessment of permitting requirements, estimated costs, and implementation timeline for selected alternatives.

PROJECT CHARTER

Project Considerations and Constraints

- Alternative solutions **will not exceed NWS minor flood stage of 6.0 feet** at the North Platte River at North Platte Gage (06693000) at the State Highway 83 bridge.
- Alternatives **will not seek modification to minor flood stage** as defined by the NWS.
- Alternatives **will not adversely impact or disrupt any irrigation and/or hydro-power** generation operations.
- Alternatives **shall not adversely impact private properties**.
- Long-term O&M costs will be considered for all alternatives.
- Alternatives will not exceed a capital cost of ~$15 million.

PROJECT APPROACH

	Phase I	Phase II	Phase III
	Project Kickoff ✓	**Geomorphic Investigation, Field Work, and Existing Modeling**	**Detailed Alternative Development**
	Review of Previous Studies/Alternatives ✓	**Evaluation of Short List** Bring Short List to Equal Level of Eval Leverage Previous Alts Info Develop Evaluation of New Alts	**Technical Analysis/Conc Design** 2D Hydraulic and Sediment Transport / Morphodynamic Modeling
EDO and Chokepoint Planning Workgroup	**Alternative Full List 2005-2023 Initial Screening** ✓	**Multi Criterion Decision Analysis**	**Multi Criterion Decision Analysis**
	Alternatives Short List Selected for Phase II	**Alternatives Selection for Phase III**	**Alternative Selection**

PROJECT APPROACH

How is this different from previous studies?

- Advancement of Previous Alternatives
  - Comprehensive look informed by previous studies
  - Information/modeling from prior studies will be leveraged
- New alternatives/ideas (VESPR)
- Multi-Criterion Decision Analysis
- Advanced modeling technology 1D to 2D sediment transport modeling
- Team members that are experts in Geomorph/Sed Transport
- Field Based Geomorphic Evaluation will Inform Sed Transport

DOC REVIEW AND ALTERNATIVES LIST

- Reviewed previous studies 2005 – 2023
  - JF Sato, HDR/Tetra Tech, SEH, ACE, EDO, RDG, VESPR…
  - Documented all Alternatives appearing in previous studies
  - Noted Any Level of Evaluation
  - Grouped into Nine Categories
- Chokepoint Alternatives **Table 1** Includes:
  - Brief Description
  - Capacity and/or Flood Control Benefit
  - Reason for Elimination
  - Reference
  - Prior Level of Evaluation (Scale of 0-4)
  - 0=New Alt, 1=Named/No Eval, 2=Conceptual Eval, 3 Hydraulic/Sed Trans Model, 4=Pursued

ALTERNATIVES LIST BY CATEGORIES

TABLE 1

- **Sediment Management** (7)
  Dredging, Modification to TCCD, Induce Headcut at Tri-County Canal Diversion
- **Cannel Modification/Construction** (14)
  Island Removal, Jetties, Channel Widening, Widen Bridges
- **Flow Bypass** (11)
  Using Existing Infrastructure, Dedicated Bypass Canal
- **Vegetation Control** (5)
- **Flood Control** (12)
  Extend State Channel, Gravel Pond Outlet Project, Levee/Berms
- **Flood Easements/Property Buyouts** (5)
- **New Alternatives** (3)
  South Platte Storage, Buyout Existing Irrigation Canal, Reduce Upstream Sediment Sources

ALTERNATIVES ELIMINATED

- **Sediment Management** (7)
  Dredging, Modification to TCCD, ~~Induce Headcut at Tri-County Canal Diversion~~
- **Cannel Modification/Construction** (14)
  Island Removal, Jetties, Channel Widening, ~~Widen Bridges~~
- **Flow Bypass** (11)
  ~~Using Existing Infrastructure,~~ Dedicated Bypass Canal
- **Vegetation Control** (5)
- ~~**Flood Control** (12)~~
  ~~Extend State Channel, Gravel Pond Outlet Project, Levee/Ber~~
- ~~**Flood Easements/Property Buyouts** (5)~~
- **New Alternatives** (3)
  South Platte Storage, Buyout Existing Irrigation Canal, Reduce Upstream Sediment Sources

Reason for Elimination

Flood Control and
Flood Easements/Property Buyouts

- Requires Intentionally Exceeding Minor Flood Stage or
- Revising Minor Flood Stage
- Violates Project Charter Constraints

SHORT LIST TABLE 2

Note: full table not shown

Level of Evaluation
0=New Alt
1=Named/No Eval
2=Conceptual Eval
3= Hydraulic/Sed Trans Model
4=Pursued

Table 2 North Platte River Chokepoint Alternatives Short List

Alt No.	Alt Type	Alternative	Description	Prior Level of Evaluation (0-4)*	Evaluation Tasks
Alternatives					
1	Sediment Management	Dredging	Dredging in main channel. Extents could be from upstream of HWY83 to Tri-County Canal Diversion.	3	- Geomorphic Evaluation - Hydraulic / Sediment Transport Modeling - Determine Dredging Extents, Volume, Frequency - Permitting Requirements - Disposal Plan - Engineering/Dredging Costs and Permitting
2	Sediment Management	Modification to Tri County Diversion	Modification to Dam to allow for sediment passage.	2	- Geomorphic Evaluation - Hydraulic / Sediment Transport Modeling - Identify Design Constraints Related to Tri-County Operations - Determine Benefit to Hydraulic Capacity at HWY 83 - Evaluate Downstream Impacts of Sediment Passage - Engineering/Construction Costs and Permitting
3	Channel Modification/ Construction	Channel Widening and/or Sand Bar/Island Removal	Widening of channel in strategic locations to increase hydraulic capacity. Removal of vegetation and widening at Sand Bar / Islands	3	- Geomorphic Evaluation - Identify Potential Locations - Hydraulic / Sediment Transport Modeling - Evaluate as Benefit to Other Alternatives - Engineering/Dredging Costs and Permitting
4	Channel Modification/ Construction	Spur Dikes/Jetties/ Bendway Weirs	Low profile bendway weirs placed downstream of HWY 83 to increase transport capacity during low flows.	3	- Geomorphic Evaluation - Determine Potential Locations - Hydraulic / Sediment Transport Modeling - Evaluate as Benefit to Other Alternatives - Engineering/Dredging Costs and Permitting
5	Flow Bypass	Construct New Canal for Bypass	Construct new canals parallel to or upside PPVID/North Platte Canal or SID/Suburban Canal	2	- Assess Feasibility of New Canal or Upsizing of Existing - Determine Required Canal Capacity to Bypass Chokepoint - Canal Sizing (new or upsized) - Evaluate Land Acquisition/Easements and Crossing Requirements - Engineering/Construction Costs
6	Vegetation Control	Chemical/Mechanical Phragmites Treatment	Spraying in the fall with shredding in areas with immediate need for flow improvement.	4	- Geomorphic Assessment - Evaluate Impact of Vegetation on Capacity and Transport - Hydraulic / Sediment Transport Modeling - Identify Benefits of Vegetation Control/Removal

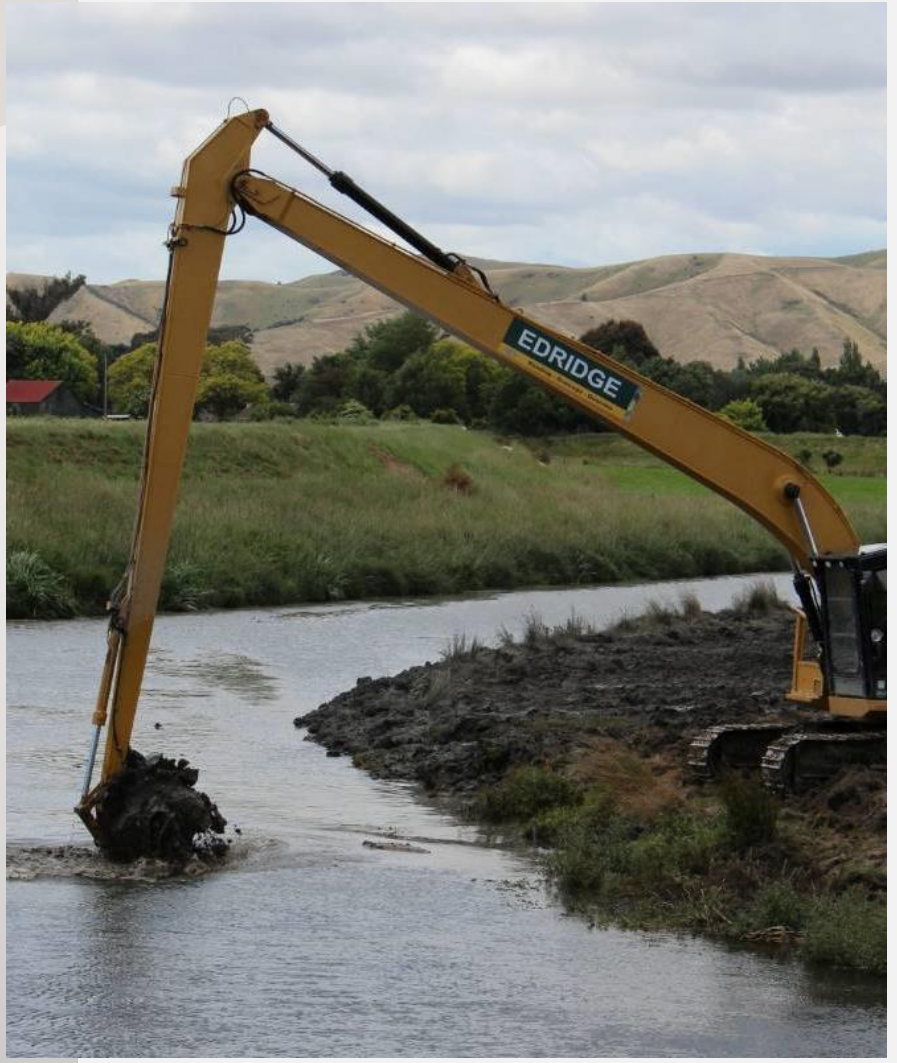
* 0 = New Alternative, 1 = Named and Eliminated with no Discussion/Evaluation, 2 = Conceptual Evaluation, 3 = Hydraulic/Sediment Model Evaluation, 4 = Pursued/Implemented

ALTERNATIVES SHORT LIST

- Dredging
- Modification to Tri-County Canal Diversion
- Channel Widening/Island Removal Above HW 83
- Spur Dikes/Jetties/Bendway Weirs
- Construct New Canal for Bypass
- Vegetation Control
- South Platte Storage
- Buyout Existing Irrigation Infrastructure
- Reduce/Control Upstream Sediment Sources

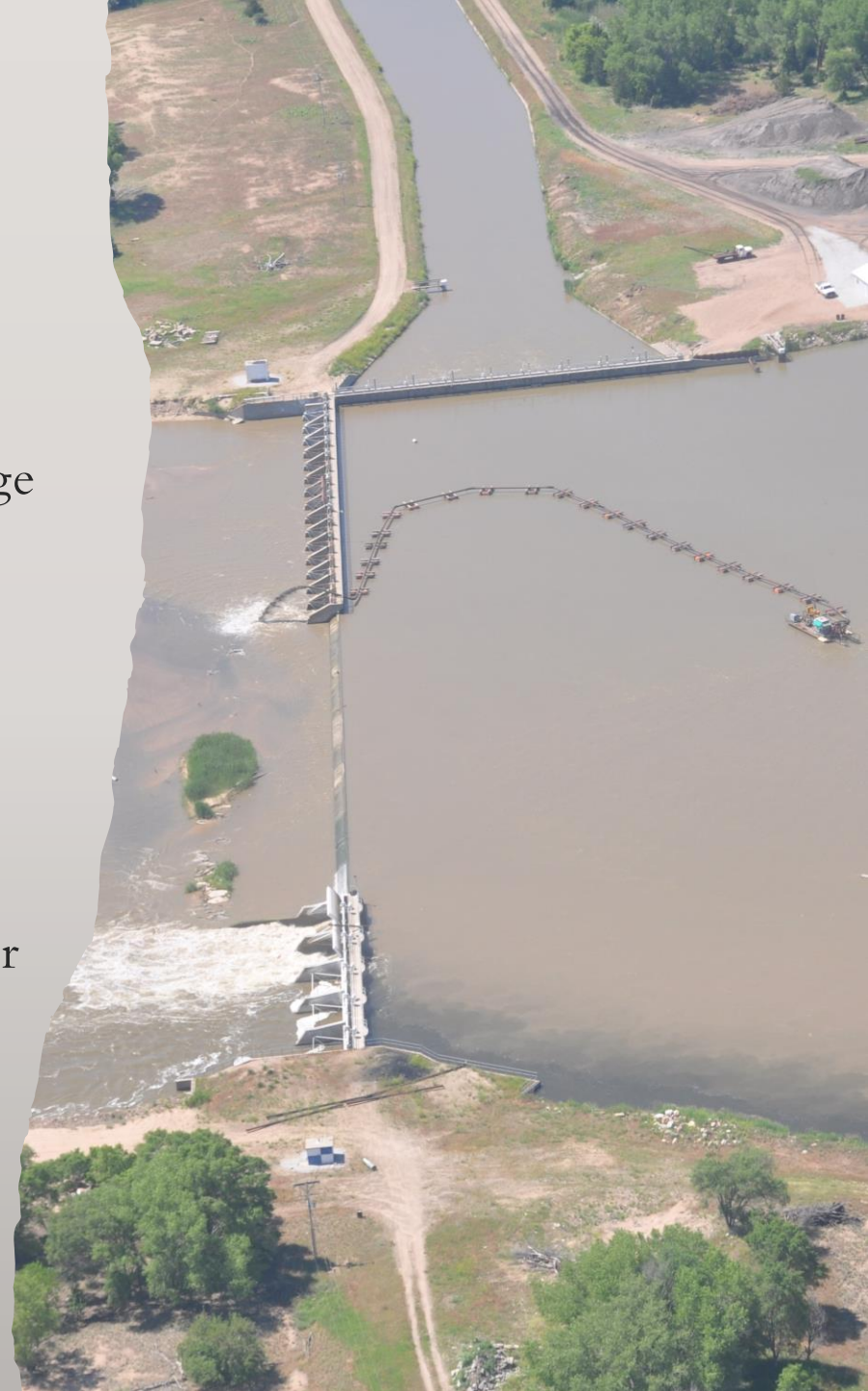
DREDGING

- **Description:** Dredging in Main Channel from Upstream of HWY83 to TCCD
- **Prior Level of Evaluation 3**: 1D Hydraulic/Sediment Transport Modeling, Cost Estimation, Limited Information on Permitting
- **Benefits**: High likelihood of increased capacity, benefit to Tri-County Dredging Ops
- **Challenges**: Sediment Disposal, Permitting, Sustainability, Cost
- **Other Considerations**: Stand alone. Jetties, channel widening, and/or modification of TCCD to pass sediment may extend time between dredging.



MODIFICATION TO TRI-COUNTY CANAL DIVERSION

- **Description**: Modify Tri-County Canal Diversion for Sediment Passage
- **Prior Level of Evaluation 1**: Initial look by RDG/VESPR 2023
- **Benefits**: Promotes sediment passage and transport, downstream benefits, enhance sustainability/longevity of upstream dredging
- **Challenges**: Not a stand-alone solution. Design to maintain current diversion/hydro power operations, permitting, downstream impacts
- **Other Considerations**: Dredging and sediment disposal needed, similar projects on the South Platte have been successful



DIVERSION MODIFICATION EXAMPLE

Lower Latham Ditch Diversion
South Platte River – Evans, CO

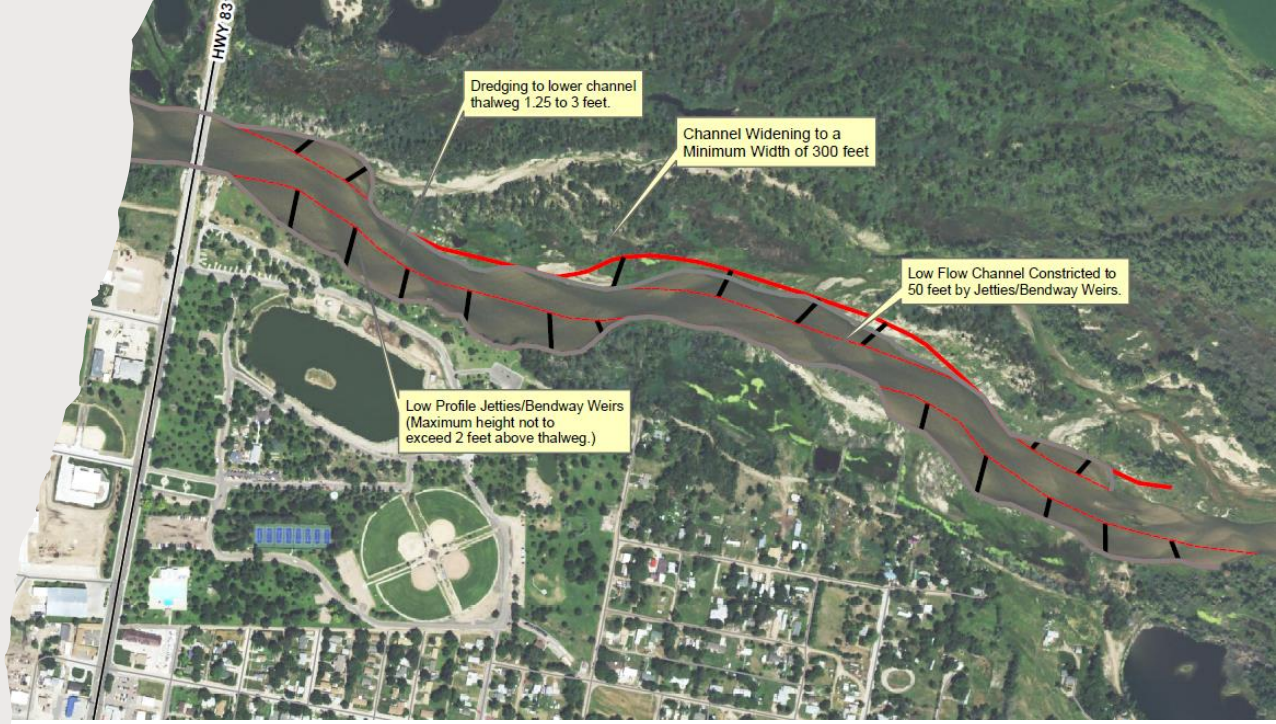
Obermeyer Gates for
Diversion, Sediment Passage, and Flood Control

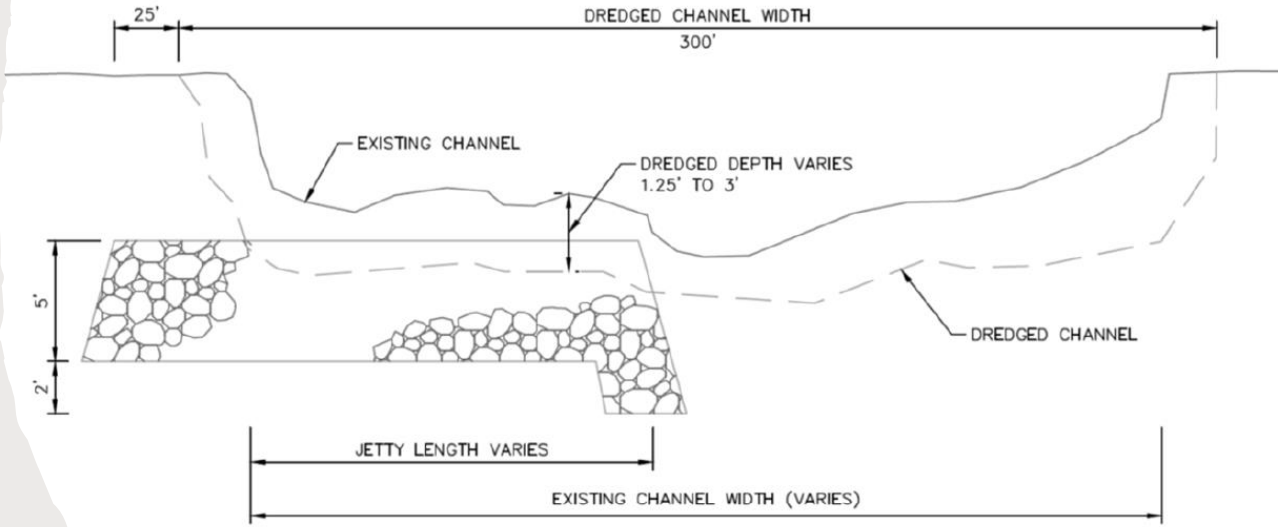
CHANNEL WIDENING

- **Description**: Widening of channel in strategic locations to increase hydraulic capacity. Also includes removal of large sand bar upstream of HWY83.
- **Prior Level of Evaluation 3**: 1D Hydraulic/Sediment Transport Modeling, Cost Estimation
- **Benefits**: Increases hydraulic capacity, promote sediment continuity, potential to be effective with dredging & jetties
- **Challenges**: Not a stand-alone solution. Design must balance widening with transport capacity, over-widening can create additional deposition, not sustainable without other measures
- **Other Considerations**: Balance between hydraulic capacity and sediment transport

JETTIES/SPUR DIKES/BENDWAY WEIRS

- **Description**: Low profile jetties downstream of HWY 83 to increase transport capacity during low flow.
- **Prior Level of Evaluation 3**: 1D Hydraulic/Sediment Transport Modeling, Cost Estimation
- **Benefits**: Sustainable option to increase transport capacity, 1D Sediment modeling indicated potential for effectiveness, could be adaptively managed.
- **Challenges**: Design to balance transport and hydraulic capacity. Permitting. Periodic dredging may be necessary to maintain hydraulic capacity
- **Other Considerations**: Dredging and channel widening needed, potential for other materials

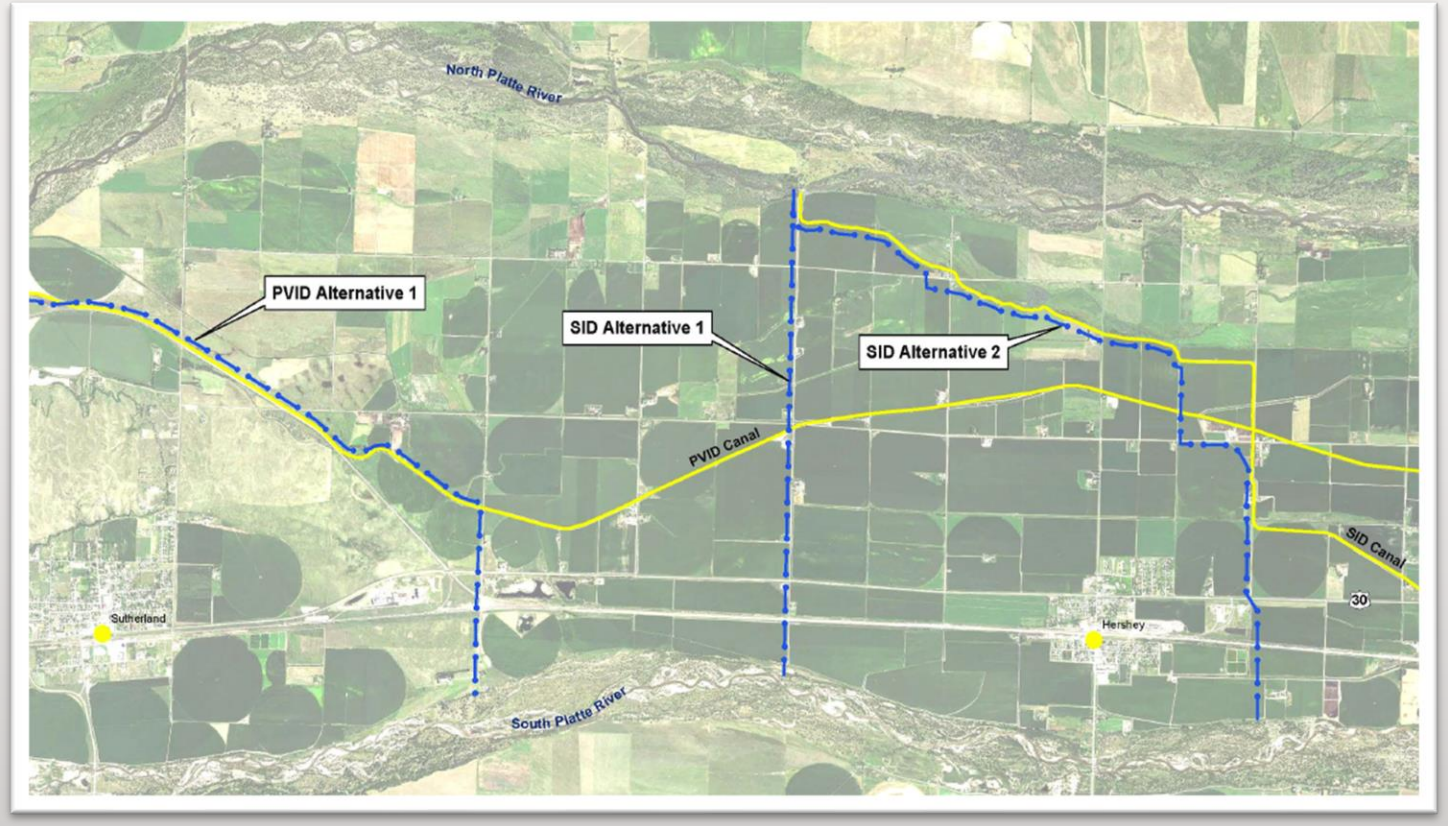




GENERAL CROSS SECTION OF CHANNEL
N.T.S.

CONSTRUCT BYPASS CANAL

- **Description**: Construct new bypass canal parallel to PVID/North Platte Canal and/or SID/Suburban Canal.
- **Prior Level of Evaluation 2**: Rough alignment, sizing, and cost estimate
- **Benefits**: Dedicated system, flexibility in timing/capacity
- **Challenges**: Land acquisition and easements, crossings, cost, long term O&M
- **Other Considerations**: Stand Alone



VEGETATION CONTROL

- **Description**: Spraying in fall with shredding in areas with immediate need for flow improvement.
- **Prior Level of Evaluation 4**: Implemented, Annual spraying since 2007
- **Benefits**: Prevents further propagation, does not require permitting
- **Challenges**: Property access, required annually, takes time so also requires an interim solution
- **Other Considerations**: More aggressive vegetation removal

SOUTH PLATTE STORAGE

- **Description**: Develop storage on the South Platte River to provide 3,000 cfs at confluence. Exchange of flows from North Platte to South Platte at a ratio would be required.
- **Prior Level of Evaluation 0**: New, No Eval
- **Benefits**: Dedicated system to deliver flows, bypasses Chokepoint
- **Challenges**: Flow exchanges, location, diversion, outlet/canal, land acquisition, permitting, cost, timeline
- **Other Considerations**: Potential to be stand alone

BUYOUT EXISTING IRRIGATION INFRASTRUCTURE

- **Description**: Buyout of irrigation canal infrastructure
- **Prior Level of Evaluation 0**: New, No Eval
- **Benefits**: Dedicated flow bypass, flexibility in timing/capacity
- **Challenges**: Conversion of surface water irrigation to groundwater, groundwater recharge needed, limited capacity – may need upsizing, long term O&M
- **Other Considerations**:

REDUCE/CONTROL UPSTREAM SEDIMENT SOURCES

- **Description**: Identify and reduce upstream sediment sources between Lake McConaughy and HWY 83.
- **Prior Level of Evaluation 0:** New, No Eval
- **Benefits**: Reduce sediment delivery to Chokepoint reach
- **Challenges**: Identification of large source that can be reduced/controlled
- **Other Considerations**: Geomorphic assessment will inform inflowing sediment loads to study reach.

ALTERNATIVES SHORT LIST

- Dredging★
- Modification to Tri-County Canal Diversion
- Channel Widening/Island Removal Above HW 83
- Spur Dikes/Jetties/Bendway Weirs
- Construct New Canal for Bypass★
- Vegetation Control
- South Platte Storage★
- Buyout Existing Irrigation Infrastructure
- Reduce/Control Upstream Sediment Sources

★ Stand Alone

NEXT STEPS

Phase II

- Alternative Evaluation of Short List
  - Bring Short List of Alternatives to Equal Level of Evaluation
  - Leverage Existing Information
  - Evaluate New Alternatives
  - Select Alternatives to move to Phase III
- Geomorphic Assessment
- Develop Existing Condition/Baseline 2D Hydraulic and Sediment Transport Modeling

Phase III

- Detailed Alternatives Evaluations
- Concept Designs
- 2D Hydraulic/Sediment Transport Modeling
- Permitting Requirements
- Cost Estimation
- Implementation Timeline
- Multi-Criterion Decision Analysis (MCDA)
- Select Alternative

ALTERNATIVES EVALUATION

- Alternatives that are identified for further study will be evaluated using a Multi-Criterion Decision Analysis (MCDA).
  - Consistent and transparent method.
  - Provides a structured process to guide alternative selection by considering a wide range of criteria.
- Criteria and corresponding weights applied to the MCDA will be determined through collaboration with the EDO and Chokepoint Planning Workgroup.
- Example criteria
  - Hydraulic capacity
  - Long-term solution
  - Capital cost
  - Addresses sediment source
  - Social Impact
  - Sustainability
  - Standalone alternative
  - Maintenance cost
  - Permitting timeline
  - Upstream/Downstream Impacts

Evaluation Criteria	Metric			Alternative 1		Alternative 2		Alternative 3		Comments
Ecology and Socio-environmental		**Criteria Weight**	**Parameter Weight**	**Raw Score**	**Weighted Score**	**Raw Score**	**Weighted Score**	**Raw Score**	**Weighted Score**	
Habitat friendly	Area (square feet) of natural materials on channel bed and banks	10%	10%	1	0.01	5	0.05	3	0.03	5=most habitat friendly;1=least habitat friendly
Potential to raise groundwater table	Subjective. Yes/No (i.e., 1/5)		50%	5	0.25	1	0.05	3	0.15	5=low potential; 1=high potential
Noise Constraints	Potential noise impact on adjacent residences.		40%	5	0.20	1	0.04	3	0.12	5=lowest noise impact; 1=highest noise impact
Hydrology, Drainage and Flooding										
Maximum velocity	Maximum velocity estimated from hydraulic model for 100-year event	15%	40%	3	0.18	5	0.30	1	0.06	5=lowest maximum velocity; 1=highest maximum velocity
Maximum flow depth	Maximum depth of flow estimated from hydraulic model for 100-year event		30%	3	0.14	5	0.23	1	0.05	5=lowest maximum depth; 1=highest maximum depth
Channel stability	Maximum shear stress channel material can withstand		30%	5	0.23	1	0.05	3	0.14	5=highest shear stress resistance; 1=lowest shear stress resistance
Technical										
Access	Difficulty of access for maintenance (limited vehicle access, difficult topography)	35%	40%	5	0.70	1	0.14	3	0.42	5=easy open access for maintenance vehicles and cleaning equipment. 1=difficult, congested, or steep topography for access

GEOMORPHIC ASSESSMENT

- Geomorphic assessment is critical to the evaluation of alternatives and interpretation of model results.
  - Observe, map, and evaluate river processes and behavior, resulting in more feasible solutions.
  - Understanding geomorphic processes coincides with evaluating numerical modeling results…Are the results realistic and reasonable from what we see on the ground?
- Geomorphic assessment will consider previous studies and incorporates new data and field observations.

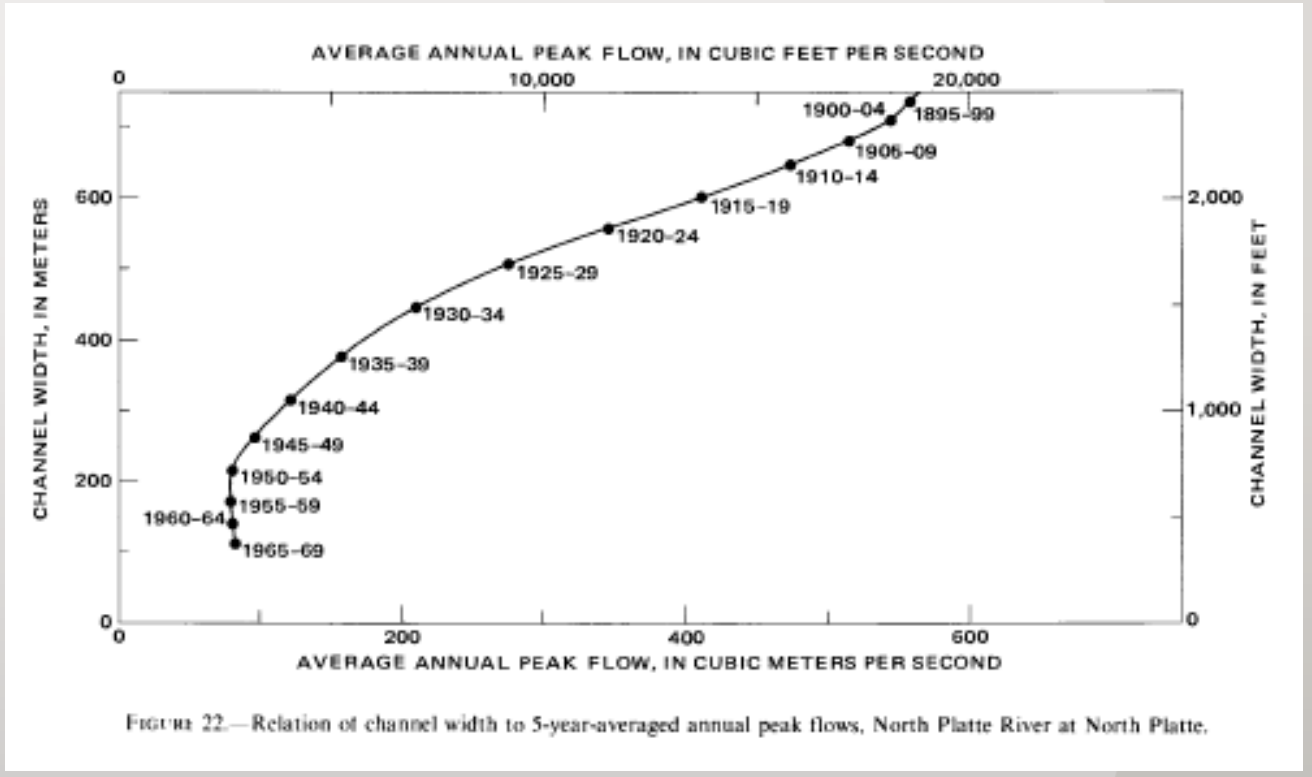


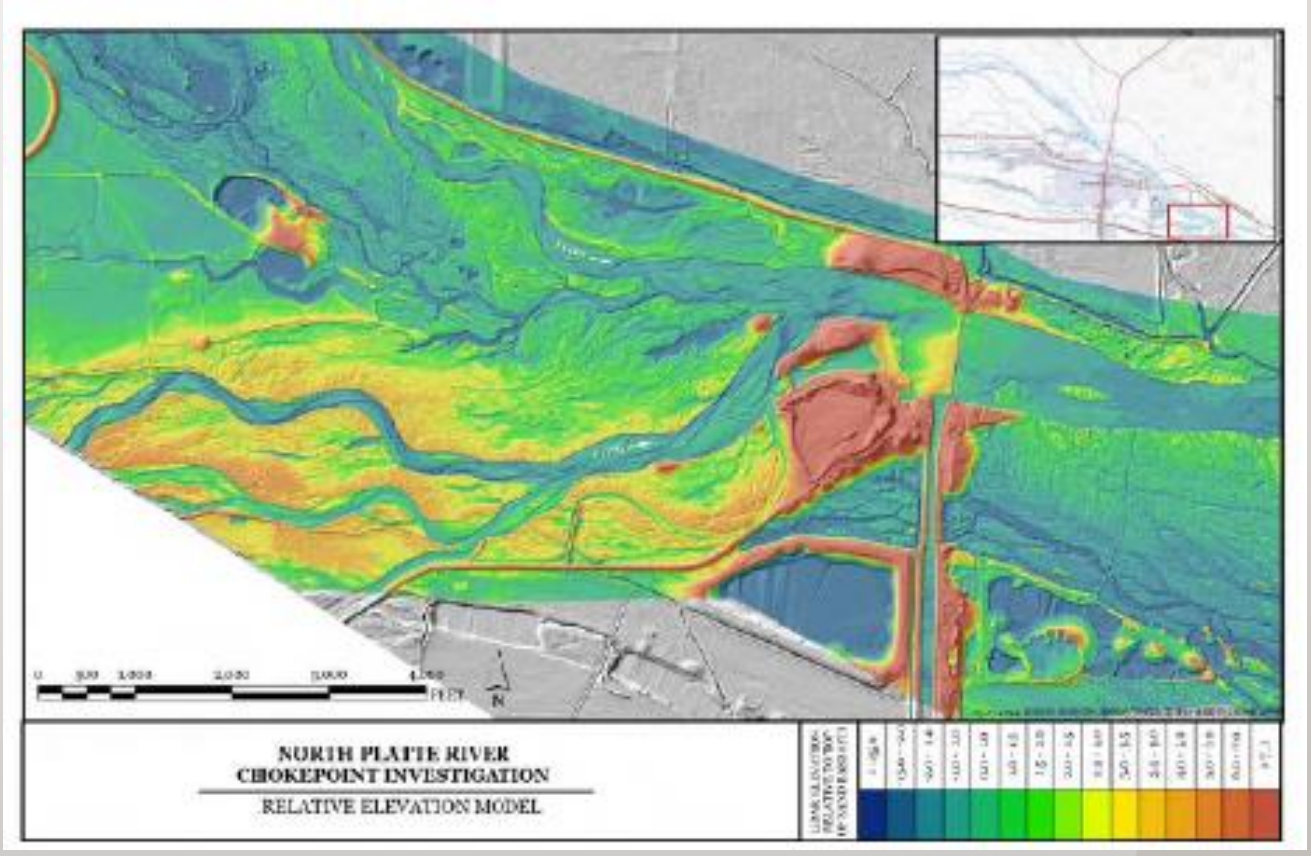
FIGURE 22.—Relation of channel width to 5-year-averaged annual peak flows, North Platte River at North Platte.

GEOMORPHIC ASSESSMENT

- Geomorphic assessment will include a field-based analysis that considers five morphological characteristics:

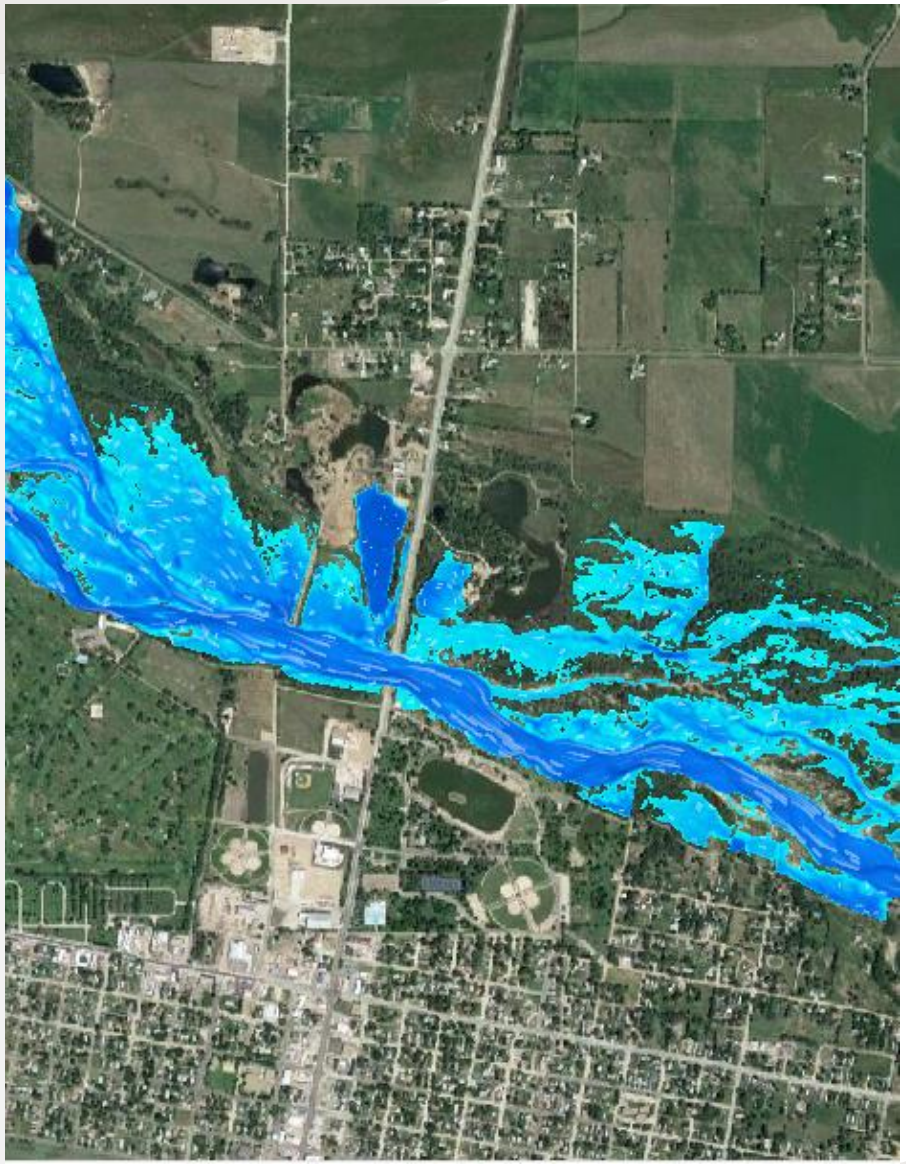
  planform, geometry, profile, pattern, and sediment continuity

- Desktop-based analyses including analysis of historical aerial imagery, creation of relative elevation models
  - Highlight important geomorphic features using LiDAR
  - DEMs of differencing to highlight erosional and depositional tendencies in the channel



2D SEDIMENT TRANSPORT MORPHODYNAMIC MODELING

- SRH-2D
- Better technology than 1D sediment modeling conducted in 2012
- Calibrated Existing Conditions/Baseline Model
- Short and Long Term Modeling of Alternatives to assess performance
- Consideration of varying hydrologic conditions



WORKGROUP FEEDBACK

Full List of Alternatives

- Questions?
- Missing Alternatives?

WORKGROUP FEEDBACK

Alternatives Short List

- Questions?
- Remove Alternatives?
- Add Alternatives?

WORKGROUP FEEDBACK

Next Steps / Phase II and III

- Questions?
- MCDA Criteria?