AtkinsRéalis

Research Proposal

Nevada Department of Transportation
Research Section

January 15, 2024

DEVELOPMENT OF ALTERNATIVE DESERT TORTOISE CROSSING CRITERIA AND DESIGNS

AtkinsRéalis

NDOT Project Champions
Nevada Department of Transportation

REFERENCE:
Development of Alternative Tortoise Crossing Criteria and Designs (PS 23-03-E2)

January 15, 2024

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Dear Kristi Holcomb & Eric Yount,

AtkinsRéalis is pleased to present the enclosed proposal for the **Development of Alternative Desert Tortoise Crossing Criteria and Designs (PS 23-03-E2)**. We are confident that our team has the necessary expertise to complete the proposed research. We understand the significance of this research in terms of reducing the risk of causing a "take" of Mojave Desert tortoises (*Gopherus agassizii*) at various culvert crossing locations across the Nevada Department of Transportation (NDOT) highway network.

Matthew Nussbaumer, a Nevada-licensed Professional Engineer (PE), will act as the Principal Investigator on the project. Matthew will be supported by Keith Hidalgo as Project Manager along with several Authorized Desert Tortoise Biologists, professional surveyors, and two additional Nevada PEs that focus on hydrologic and hydraulic engineering.

AtkinsRéalis staff are very familiar with the challenges of designing water conveyance structures in the southern Nevada region to handle flash flooding and monsoon events. We have direct experience overcoming the challenges with designing structures to manage these events while maintaining passage for native wildlife.

Please contact me if you have any questions regarding this proposal. Thank you for this exciting opportunity to help NDOT find a solution to this critical operations and maintenance challenge that protects the Mojave Desert tortoise and maintains roadway safety to the traveling public throughout Nevada.

Sincerely,

Keith Hidalgo, SCE, PWS, AMB
Project Manager

RESEARCH PROPOSAL

1. TITLE:

Development of Alternative Desert Tortoise Crossing Criteria and Designs

2. PRINCIPAL INVESTIGATOR:

Name: Matthew Nussbaumer, PE
Title: Senior Water Resources Engineer
Address: 2270 Corporate Circle, Suite 200, Henderson, NV, 89074
Email: matthew.nussbaumer@atkinsrealis.com
Telephone number: 775-789-9822
Additional details: Matthew's former employment with the NDOT in the Hydraulics division gives him in-depth familiarity with applicable design processes and standards, project delivery, and typical materials. He has direct recent experience with desert tortoise passage issues from the I-15 Truck Climbing Lanes project and from past experience while working on roadway projects on these same routes in southern Nevada at NDOT as a hydraulic engineer, which makes him the ideal professional to lead our design and research efforts.

3. PROBLEM DESCRIPTION:

The AtkinsRéalis project team understands NDOT's challenges with providing functioning culverts that facilitate surface and flood flows to protect the traveling public as well as the challenges of facilitating the movements of the Mojave Desert tortoise, a federally endangered species. NDOT provided a thorough problem description in **PS 23-03-E2** which AtkinsRéalis is providing a response to in the following sections of this proposal.
There is a need to develop criteria and plans for retrofitting culverts into desert tortoise crossings that can withstand multiple large hydraulic events with minimal maintenance, while also being easily navigated by desert tortoises.

The AtkinsRéalis project team understands that no research has been completed within the range of the desert tortoise on developing alternative crossing designs to make maintenance easier and more cost-effective for the transportation agencies. AtkinsRéalis is proposing to provide support to NDOT to find alternative crossing designs that can withstand multiple hydraulic events without requiring extensive maintenance, while also providing effective crossing opportunities for desert tortoises. The alternative designs developed through this research would potentially reduce construction and maintenance costs, save tax-payer money, reduce habitat fragmentation, and increase population viability for the desert tortoise.

4. BACKGROUND SUMMARY:

a. NDOT'S current practice related to this problem.

It is our understanding that the NDOT champions for this effort thoroughly summarized the ongoing research in Arizona, California, and Nevada for Mojave Desert tortoise wildlife crossings. A key finding includes the risk of loss of genetic transfer among populations that become separated due to roadway barriers. This is an ongoing concern that has united several federal, state, and local agencies to find solutions, as evidenced by the Desert Tortoise Management Oversight Group (MOG) meetings. The MOG includes the Federal Highway Administration (FHWA) in Nevada; Bureau of Land Management (BLM) in Arizona, California, and Nevada, and Utah; the U.S. Fish & Wildlife Service's (Service) offices in Region 2, Region 6, and Region 8; Department of Defense (DOD) in southern California; the National Park Service (NPS); the U.S. Geological Survey; Arizona Game and Fish Department; California Department of Fish and Wildlife; Nevada Department of Wildlife; Utah Division of Wildlife; Caltrans; NDOT; Clark County, NV; Lincoln County, NV; Washington County, NV; Quad States Local Government Authority; and the non-profit National Fish and Wildlife Foundation.

AtkinsRéalis recognizes that NDOT's current practices involve the retrofit of existing culvert inlets and outfalls utilizing standardized methods, practices, details, and materials. Retrofits are designed using standard sizes of riprap with average rock sizes ranging from D50 of 6 inches

up to D50 of 36 inches. While this riprap provides necessary scour/erosion protection, it can be detrimental to tortoise passage. Tortoise, especially juveniles, may become trapped within voids in the riprap and eventually die. Conversely, NDOT has recorded just one “take” of a tortoise along a Nevada highway due to a failed crossing. Improving existing culverts, in conjunction with strategically placed tortoise barrier fences, will mitigate the potential loss of desert tortoise.

As such, the Service is requesting that NDOT and other transportation agencies install tortoise crossings on federal projects as frequently as every two miles.

Under the prior NDOT research project (Report No. 733-19-803), the final report conceptually proposed alternative erosion control designs consisting of turf reinforcement mats (TRMs). These systems come with many downsides, such as use of plastic materials that break down over time due to UV degradation; materials that are easily torn from hydraulic forces, debris, and maintenance activities; materials that cannot tolerate abrasion well; and adversely affect systems that rely on vegetation to help anchor the material, which is limited in the Mojave Desert. As such, TRMs were deemed unsuitable and were not advanced for implementation.

Given the limited availability of viable alternative designs, most tortoise crossings resort to backfilling riprap with either native material or a granular/gravel backfill. However, when storms occur, the soil and gravel wash away and erode the tortoise walkways, which can cause a tortoise to become trapped in riprap voids as previously mentioned. Even though the crossings are regularly inspected, with deficiencies reported to the maintenance, NDOT crews are often short-staffed and overburdened with public safety priorities. As a result, it can take several months to repair the tortoise crossings, leaving them both useless and dangerous to desert tortoises for most of the year.

b. Finding of a preliminary literature search and how this research is leveraging and not duplicating prior research.

The previous NDOT research project provided a comprehensive literature review with valuable information and guidance on the physical capabilities and limitations of desert tortoises. This information will be referenced during the site evaluation, culvert selection, and development of a design alternative for culvert retrofit alternatives. Since connectivity is a high priority for species recovery, there is an abundance of research on benefits of connecting desert tortoise populations with crossings. Most of this research in Utah, California, Arizona, and Nevada identifies areas that would most benefit from tortoise crossings and demonstrates how tortoises are using crossings. Clark County Desert Conservation Program (DCP) completed their Culvert Inspection for the Purposes of the Desert Tortoise Passage Project in 2021. This project rated the conditions and suitability of existing culverts to safely allow tortoise passage. The inspection and data set gave a grade or rating of 1 through 5 to each culvert tied into tortoise exclusionary fence in Clark County, based on the ability for a tortoise to pass through. AtkinsRéalis understands this past research and the need for this data to be utilized in prioritizing and selecting desirable locations to complete the design/research in this project.

c. Why this research is needed by NDOT beyond the existing research.

The proposed research/design under **PS 23-03-E2** will develop specific designs and provide updated design criteria to accommodate tortoise passage across southern Nevada and neighboring states, while providing longevity of materials and minimizing maintenance complications for NDOT highway crews. Delays to identifying solutions could have several impacts, including delays to future projects, increased permitting costs, and increased maintenance demand and expenditures. While the two previous studies listed above have assessed crossing locations and uses, the previous studies did not focus on creating specific designs and criteria to meet the parameters identified for PS 23-03-E2. The outcome of this research will be used by NDOT in

the design and construction of future road projects.

5. PROPOSED RESEARCH/DESIGN TASKS:

The primary objective of this project is to utilize findings from prior research and subsequently develop guidance, criteria, and guidelines to support retrofit designs and engineering plans using appropriate materials. These designs and plans will be used to identify the most suitable design criteria and materials to retrofit culvert inlet and outlet treatments located on NDOT highways within current tortoise range to facilitate desert tortoise crossings while minimizing culvert maintenance requirements. This will improve population genetics and the long-term viability of the Mojave Desert tortoise in southern Nevada. The proposed research tasks and objectives are detailed below.

a. Technical objectives:

The objectives of **PS 23-03-E2** include:

- Identify four culvert crossings along Nevada State Route 160 (SR 160) to evaluate and retrofit into desert tortoise culvert crossings with low maintenance requirements.
- Obtain topographical surveys to develop creative designs, including engineered plans.
- Produce final report documents that provide details of the design efforts performed.
- Provide implementation-ready construction plans, specifications, and estimates.

b. Research methodology/tasks:

Our objectives will be accomplished by completing the specific tasks described below.

i. **Location Selection:** Review existing culverts with ratings of 4 or 5 for passability (utilizing the Clark County DCP's Culvert Inspection for the Purposes of Desert Tortoise Passage project rating system), refer to Exhibit 1 and Photographs 1 and 2 for examples. The watersheds draining to SR 160 consist of alluvial fans and are common in southern Nevada. The geologic and hydrologic processes typical of alluvial fans result in high erosion potential, a lack of defined and/or stable channels with large deposits of boulders, gravels, and fine sediments also known as alluvium. This presents difficulties with drainage facilities crossing SR 160 and high variability and the general overall instability.

Some culverts and locations may not be suitable for retrofit due to several reasons including facility size/flow requirements, right-of-way (ROW), grading etc. An alternate objective not identified that may be considered is deterring desert tortoise passage and the development of fencing and deterrent options/alternatives.

Once these culverts are identified (approximately 15 found on SR 160 within the USFWS's 1-High Priority Road Segment) AtkinsRéalis will review and update the culvert passability rating as maintenance work and other improvements have occurred since the DCP report was published. AtkinsRéalis will then identify four culvert crossing locations along SR 160 that have existing conditions or obstacles that prevent, hinder, and/or otherwise make desert tortoise passage unsafe. The conditions or obstacles would typically include steep inlet/outlet slopes, riprap with large voids, head cuts or drop offs and/or deep pools etc. The selected culverts would typically be grade 4's or 5's (utilizing the DCP's project rating system).

ii. **Existing Conditions Analysis (ECA):** Once crossing locations have been identified and agreed on by NDOT and project stakeholders, a hydrological analysis will be completed to determine design flows at each location. A culvert hydraulic analysis will then be completed using existing culvert capacity and the design flows to compile the necessary data to evaluate the hydraulic requirements and develop/evaluate alternatives that meet both the hydraulic function and tortoise passage needs.

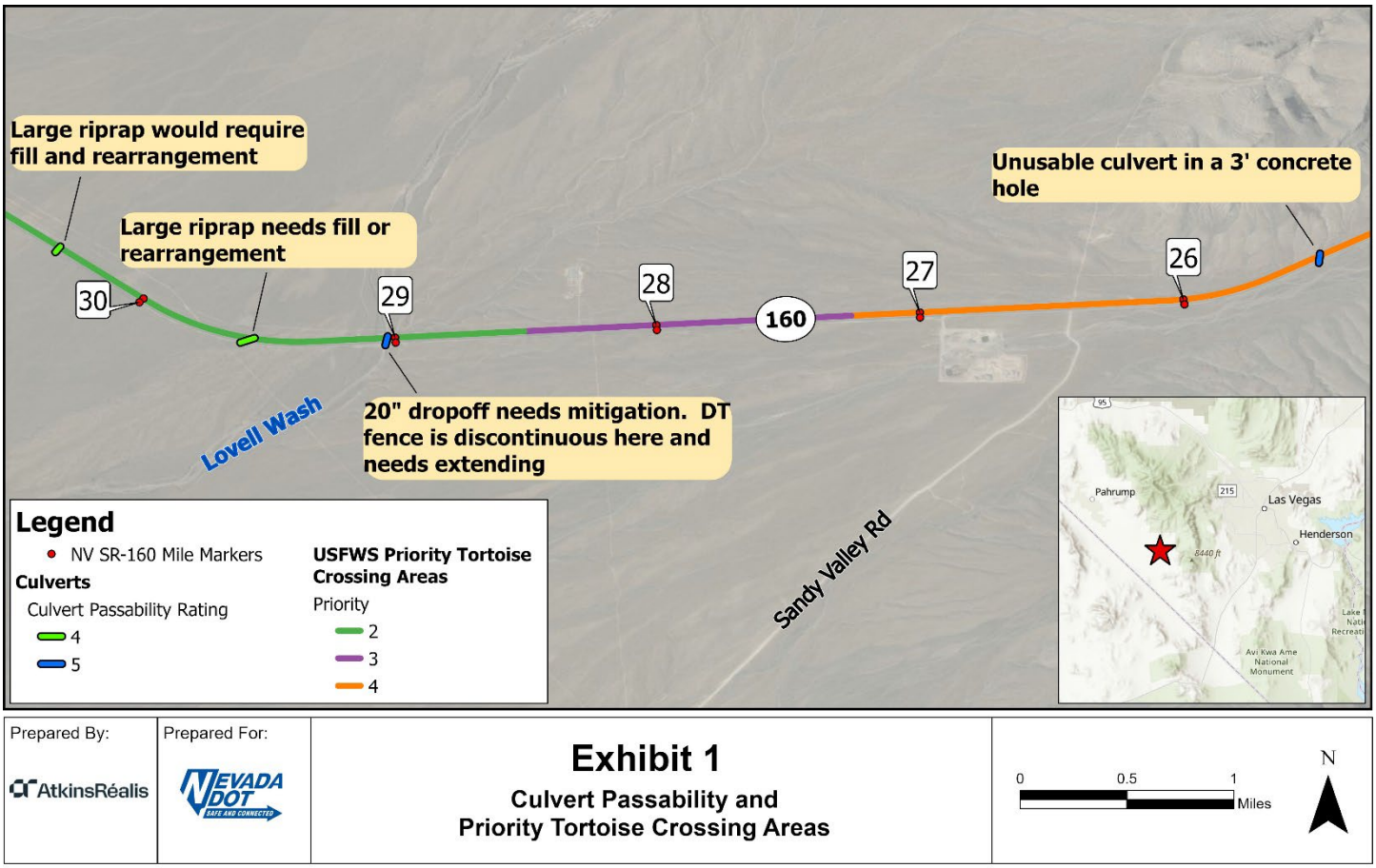

Exhibit 1: Example of a culvert crossing locations with a “Passability Rating” of 5 from the DCP Research Study.

Photograph 1: Example of 3-cell reinforced concrete box (RCB) culvert with headcut along SR 160.

Photograph 2: Example of corrugated metal pipe (CMP) with voids in large rock riprap.

Based on SR 160 being classified a principal arterial, AtkinsRéalis, unless directed otherwise, will focus on designing the culverts and inlet/outlet protection to convey runoff from the 25-year design event without overtopping the roadway and to ensure that the treatment would not sustain significant damage/erosion. Depending on the age of the culverts, they may not have been originally designed to the current criteria. Our team will evaluate alternatives and design the culvert crossings based on the lesser of the current culvert capacity or for the 25-year event.

iii. **Alternatives Development/Preliminary Design:** Develop alternatives that utilize common, non-proprietary materials that are durable against the harsh desert environment, provide the necessary energy dissipation, and resist impact potential from abrasion and debris. Seek input and buyoff from NDOT and project stakeholders. Items/materials initially being considered include partially grouted riprap, grouted riprap and articulated concrete block. Draft reports for each of the four culvert crossing locations will be submitted with the engineering plans detailing at least one design alternative and text which should outline culvert flow rates, topography, existing infrastructure, and other features. This will provide a comparison of the strengths and weaknesses of new erosion control designs compared to the designs and practices currently used in many of the high-flow tortoise crossings in District 1.

iv. **Intermediate Design:** Further advance designs that are location/site specifics that take into consideration elevations/slopes, right-of-way, fencing etc. and that are stable/durable, maintenance friendly, do not hinder maintenance of the structure, and that are not dependent on the establishment of vegetation (i.e., turf reinforcement mats). AtkinsRéalis believes that focusing on designs that maintain tortoise friendly configurations and geometry and that provide the necessary energy dissipation of runoff from the design event will be the key to coming up with solutions.

v. **Final Design and Report:** Produce a final report detailing the research/design performed, including background, methodology, evaluations of current and past crossing designs, lessons learned during the design process, and, if applicable, criteria for successful design and implementation of tortoise crossings, recommendations, and implementation plans. This final report will contain guidance and design criteria for desert tortoise crossings and engineering plans that will be ready to be used on future NDOT projects in desert tortoise habitat that require culvert retrofits.

c. NDOT staffing and equipment resources that will be needed to accomplish the proposed research.

AtkinsRéalis will work with the NDOT project champions to identify and use available NDOT information, including any available detailed topographical survey, culvert as-builts, GIS and\or design files (CAD, Microstation), and photographs. AtkinsRéalis will work with the NDOT project champions to identify additional NDOT staff to conduct technical design and report reviews, attend stakeholder meetings online and in the field, if necessary, and complete final reviews of all reports and designs. At a minimum, involvement of lead NDOT maintenance personnel will be invaluable during reviews and on-site investigations to facilitate the best design criteria and culvert retrofits.

Deliverables for each task of the proposed research may include:

a. Interim reports, synthesis documents, and final report.

- One preliminary report for each of the selected culverts (at least four).
- Final report with design guidelines/criteria.
- Designs and engineering plans.
- Maintenance recommendations and guidelines.

b. Any programming codes, databases, and other tools to be developed.

Other materials that may be used for this research project will include:

- Geographic Information Systems (GIS) files (shapefiles or geodatabase)
- Design files (CAD, Microstation, etc.)
- Global Positioning System (GPS) data
- Un-manned Aerial Vehicle (UAV) data

c. Models to be developed using proprietary or other programs.

No proprietary models or proprietary programs will be used that are not currently available to NDOT. AtkinsRéalis will use standard modeling software to perform the hydrologic and hydraulic analysis to facilitate the design of culvert end treatments.

Our project team, in coordination with NDOT and stakeholders, will select culverts and prepare designs, standards, and develop design criteria to identify appropriate retrofits for existing and new culverts to facilitate tortoise crossings using longer lasting and lower maintenance materials.

6. URGENCY AND ANTICIPATED BENEFITS:

As identified in **PS 23-03-E2**, retrofitting culverts to facilitate tortoise crossings is extremely urgent to construct safe crossings for desert tortoises that maintain flood flows.

a. Urgency and benefits for tortoise populations in southern Nevada and surrounding states.

This research highlights the need to mitigate inbreeding depression caused by habitat fragmentation, which occurs when a species-isolated population resorts to inbreeding to survive. Without acceptable materials, designs and design criteria for retrofitting culverts into well-functioning tortoise crossings that maintain safety for the traveling public, NDOT will continue facing challenges with successful project delivery and honoring commitments through the ESA consultations. It is imperative that this research be done as soon as possible, as the Service is requesting tortoise crossings every two miles on new projects. These crossings are being installed in high-flow areas where the suggested erosion control measure for culverts is riprap that requires frequent maintenance.

b. Benefits to maintenance in a challenging desert environment.

The current practice/approach results in the need to use hundreds of thousands of dollars spent on less-than-ideal designs that have limited function, are maintenance intensive and put tortoises in danger. The sooner this research can be completed, the sooner NDOT can begin to save money by implementing more efficient tortoise crossing designs while protecting the long-term viability of the tortoise population and maintaining the safety of the traveling public.

Within the most recent Programmatic Biological Opinion (PBO) (2022-0030693-S7), the FHWA, NDOT, and the Service have identified planning measures to install new tortoise underpasses, tortoise barrier fence, and retrofits to existing culverts to facilitate crossings. The identification of priority highway segments by the Service, as well as information from the DCP's past analysis on culverts (which ranked each culvert on ease of which the tortoise can pass through, from least passable to most passable), has facilitated the next steps in accommodating tortoise crossings.

c. State legislative action to fund crossing retrofits.

With the 2023 Assembly Bill Number 112 (AB-112) passed, NDOT will now be able to continue to develop a new approach to desert tortoise crossings by implementing design criteria on culvert retrofits, as AB-112 sets up the creation of and provides funding of a Wildlife Crossings Account in the State General Fund. AB-112 also requires the Director of the DOT to review standards and specifications necessary for incorporating wildlife crossings and related highway features in NDOT highways, which is what **PS 23-03-E2** accomplishes.

The AtkinsRéalis team will research and identify design criteria and alternative options to benefit tortoises through retrofitting culverts to connect tortoise populations across highway barriers to

Assembly Bill No. 112–Committee on Growth and Infrastructure is an ACT relating to wildlife and wildlife crossings which creates the Wildlife Crossings Account in the State General Fund which will be managed by NDOT. AB-112 directs NDOT and NDOW to develop and publish an inventory\list of projects which can facilitate wildlife crossings. AB-112 also directs NDOT to review and determine standards and specifications necessary to incorporate wildlife crossings across the state of Nevada.

enhance genetic flow between populations and reduce risks to tortoises becoming entrapped at crossings. Our team will work to ensure our designs also benefit maintenance activities and prolongs the life of each crossing location.

7. IMPLEMENTATION AND DESIGN PLANS:

The research design proposal is part of the early phase of Stage Three, Controlled Field Demonstration Stage, of the Five Stages of Research Deployment. This early phase is the preparation for the full-scale testing of retrofitting a culvert to facilitate tortoise crossings. This phase requires identifying creative concepts and alternative designs, topographical surveys, engineering design plans and details, and technical reporting on four different culvert/crossing locations with varying slopes/grades to offer a range of designs based on different conditions along SR 160. The results of this research design project will lead to the next phase of Stage Three and will formally install the culvert retrofit by NDOT and their contractor.

a. Tasks needed to develop an implementation plan for the research results.

AtkinsRéalis has identified the following tasks to facilitate the completion of this research design project:

- Project kick-off meeting with NDOT and relevant stakeholders.
- Site reconnaissance for the culvert selection and documentation process.
- NDOT and other stakeholder review and input on final culvert selections.
- ECA report with NDOT and other stakeholder review.
- Topographical survey of selected culverts to facilitate accurate design and hydrological modeling.
- 30% design-NDOT and other stakeholder 30% design review to identify 30% design criteria.
- 60% Design-NDOT and other stakeholder 60% design review to identify 60% design criteria.
- Final Design-NDOT and other stakeholder final review.
- Finalize PS&E documents, Final Report, and Guidelines/Criteria
- Optional Task-Desert tortoise deterrents and fencing options/alternatives.

b. Task to develop a detailed implementation plan for NDOT.

- Provide design criteria and standards for utilization during the design on future NDOT project(s) in District 1, southern Nevada.
- Have “shovel” ready plans, specifications and estimates ready for NDOT to incorporate in an upcoming roadway project on SR160.

No institutional, political, or socio-economic barriers to implementation of the research are anticipated.

8. PROJECT SCHEDULE:

AtkinsRéalis has a wealth of experience with a variety of scheduling programs that can be tailored to this research design project and will facilitate the needs of the NDOT champions. We will integrate major milestones, deadlines, and seasonal activities of the desert tortoise (active

and less-active seasons) into our schedule that will be tracked in Microsoft Project.

At the project start, a baseline schedule will be developed using the NDOT-approved project specific work breakdown structure (WBS) framework. It will include internal quality reviews, NDOT reviews, and reviews by other stakeholders or agency staff (e.g., the Service and Nevada Division of Wildlife). This baseline schedule will be updated regularly, depending on new information identified throughout the design process. This master schedule will rely on input from subject matter experts (SMEs), NDOT champions, the WBS, research design project milestones on plans, specifications, and estimates (PS&E), and deliverables. Refer to **Appendix B** for a draft baseline schedule for an early estimate of the WBS sequencing, milestones, and deliverables for the research design project.

9. FACILITIES AND EXPERTISE:

AtkinsRéalis is a full-service engineering company with 3,600 employees in the United States, including offices in Henderson and Reno supported by over 150 employees. Through our depth of resources in Nevada, across the US and worldwide, we have assembled a team with an unmatched balance of research and design experience to develop and design a series of solutions. Our team, shown in Exhibit 2 includes wildlife biologists, water resource engineers, and surveyors with the capabilities, experience, and with the background to complete the **PS 23-03-E2** research design project successfully.

Our local team has maintained an active and strong working relationship with NDOT for decades. We have designed some of the state's and NDOT's largest and most important projects over the years, including the I-15/CC 215 Interchange, Project NEON Design-Build, and US 395 Carson City Freeway Design. This sets us apart and demonstrates our strong familiarity and understanding of NDOT practices and delivery of project designs and construction-ready documents. Our resources are available to provide PS&E documents needed for the selected alternatives.

Exhibit 2. AtkinsRéalis proposed project team

The Project and our team will be lead and managed by Keith Hidalgo who has 20+ years of experience as a biologist, task lead, and project manager. Keith has proven managerial experience working with NDOT on complex transportation projects including the I-15 North Phase 3 Environmental Services during construction, as well as managing subconsultants on the I-15 North Phase 3 Design project and I-15 North Truck Climbing Lanes Design project. Supporting Keith is a team of engineers and biologists with experience handling complex issues with drainage infrastructure and desert tortoise protection.

Matthew Nussbaumer, PE (license in Nevada), will lead the research and design efforts. Matthew recently retired from the NDOT Hydraulics Division, and his 20 years of NDOT drainage and stormwater design experience including projects involving concrete and riprap channels, culvert energy dissipators, detention/water quality basins, storm drains, culverts, and erosion control. During his time with NDOT, Matthew worked on projects on most of the key routes within the south Nevada desert tortoise habitat. Matthew also successfully managed NDOT's Lake Tahoe TMDL Program for 12 years. Lake Tahoe is an environmentally sensitive area with environmental and regulatory issues that make it challenging to deliver projects. During his time managing the program, Matthew delivered the last remaining projects identified in the Environmental Improvement Program which had

been delayed by issues including funding, permitting, stakeholder priorities and numerous other obstacles. He is familiar with NDOT's project delivery process and effectively partners with stakeholders and NDOT maintenance personnel to incorporate critical input accordingly.

Matthew will be supported by Clark Barlow and Mark Elkouz, both of which are state of Nevada registered Professional Engineers. Clark is the PM and technical lead for a project to update the Clark County Regional Flood Control District's *Hydraulic Criteria and Drainage Design Manual*. The manual includes comprehensive hydrology and hydraulic design guidance and criteria updates related to this research project's needs. The manual update will also include additional info specific to desert tortoise considerations and general guidance and limitations for planning, design, and implementation of flood control projects in Clark County. Clark also managed the design of Weir 5 which is part of the Lower Las Vegas Wash Stabilization Program which utilized advanced hydraulic modeling to verify hydraulic function and structure stability. Clark and Mark work in AtkinsRéalis' southern Nevada office and have the requisite hydrology, hydraulic modeling, and design experience to make this a successful project.

Brett Jefferson is a Professional Land Surveyor who will complete topographical surveys as necessary for selected culverts that have either outdated or nonexistent topographical surveys, so that accurate designs and plans can be generated for each culvert. Refer to Appendix A for CVs and resumes of the proposed AtkinsRéalis project team.

The AtkinsRéalis project team is also able to pull in additional expertise from structural and roadway engineers/designers to facilitate any needed designs to ensure other interacting elements of the highway if required.

The AtkinsRéalis project team has experience working with NDOT on numerous design and construction projects over the last 20+ years and is familiar with complying with the FHWA\NDOT and the Service's PBO including the latest PBO (2022-0030693-S7), as well as individual project BOs (e.g., 84320-2010-F-0285.R002). We have been involved with recent design and construction work, both completed and still in process, and have followed PBO processes such as Pre-construction Planning – Planning 1 discussions on fencing and tortoise underpasses on the I-15 North Phase 3 project and the I-15 Truck Climbing Lanes project. AtkinsRéalis staff have worked directly with NDOT in the decision-making process to facilitate tortoise crossings. While one culvert on the I-15 Truck Climbing Lanes project was fenced off to prevent tortoises from becoming trapped, another culvert was designated as the primary crossing location, so the design used native material in riprap areas to minimize impacts to tortoises.

From an inspection and maintenance perspective, AtkinsRéalis has also observed the construction of culverts at locations on the I-15 North Phase 3 project and is familiar with required measures in the PBO for Construction Measures 1-13 during construction projects. We are also experienced with the use of riprap with native soil material to facilitate desert tortoise crossings. Due to southern Nevada's climate and monsoon season, backfill and/or riprap can be washed away downstream. This recently happened in September 2023 due to extreme rain events in southern Nevada.

We also understand NDOT's goals of connecting tortoise populations in USFWS priority road segments (1 and 2) as these segments align with the DCP mapped priority crossing locations. A key element to facilitating wildlife crossings is the inclusion of wildlife fencing or tortoise barrier fencing. However, installation of tortoise fencing on all road segments is cost prohibitive, so we recommend that NDOT continue prioritizing the highest risk crossings.

10. BUDGET: Excluded per notice in **PS 23-03-E2.**

11. NDOT CHAMPION, COORDINATION AND INVOLVEMENT: The AtkinsRéalis project team will work collaboratively with the NDOT project champions, Kristi Holcomb, and Eric Yount, to

complete the identified research and design tasks above. The process for communicating with the NDOT project champions and SMEs is provided in more detail below.

COMMUNICATION PLAN

Process for interaction within internal research project team

AtkinsRéalis will proactively work with each team member to efficiently integrate them on tasks, with special attention provided to the newer team members. This includes collaboration with SMEs in wildlife biology, engineering, and surveying. These SMEs may represent BLM, USFW, NDOT and others.

Team Coordination: Meetings will be set on either a weekly or bi-weekly basis between Keith, Matthew, and required SMEs to evaluate progress, discuss obstacles and constraints to effective design development, provide a high-level forum for interdisciplinary coordination and to prioritize project activities. Resource allocation and balancing will be a frequent discussion topic and action item. When it is necessary to schedule meetings with NDOT champions or other staff, these internal meetings would be used to develop a full understanding of the issues, the potential impacts to each technical discipline, and to craft an agenda and action items for the future meeting with NDOT champions. This type of preparation sets the stage for the efficient use of precious meeting time and accelerates decision-making.

With experienced staff located locally in the City of Henderson, we can provide the most qualified and cost-effective team ensuring the necessary technical expertise is available to NDOT to deliver results.

The project team can also make use of communication efficiencies as the team is solely composed of AtkinsRéalis staff and no additional third party subconsultant communication steps will be required.

INTERACTION WITH CLIENT AND STAKEHOLDERS

Frequent communication with NDOT champions and key staff is critical to the success of this research and design project. We will keep NDOT up to date on the progress of technical work through meetings, clear reporting, and feedback on scheduling. To keep the broader project team and SMEs engaged and informed, AtkinsRéalis proposes monthly client coordination meetings, at which all attendees will receive context and become familiar with the potential project challenges faced, which will allow for a better-informed and more focused collaboration.

Over-the-shoulder meetings will be planned in coordination with the NDOT champions to ensure attendees include decision makers with the correct, relevant information to assure issue resolution. This promotes meeting efficiency, spurs decision making, and avoids repetition of multiple meetings on the same topic. Keith will work with Matthew to identify and manage project risks using AtkinsRéalis' standard array of tools. Risk review and assessment will occur at regular intervals; risk status will be updated; emergent risks added; and, as appropriate, risks will be retired.

Our team recognizes how important it is to both NDOT champions and other staff for proactive, efficient, and cost-effective communication of the progress and successes of the research design. Since not all groups receive and respond to information in the same way, we will implement innovative and cost-effective approaches to communication. The AtkinsRéalis project team will focus on using available technologies to provide efficient means of communication to discuss potential design elements, including Microsoft Teams meetings, emails, and phone calls. When/if required, AtkinsRéalis staff will meet with NDOT on site for in-person collaboration.

APPENDICES

Appendix A. RESUMES

Keith Hidalgo, SCE, PWS, AMB

Project Manager

Total years of experience

21

Years with firm

6

Education

M.A.S., Environmental Policy and Management, University of Denver, 2011

B.S., Wildlife Biology, Colorado State University, 2001

Certificate: Environmental Information Systems, University of Denver, 2007

Certifications

Senior Certified Ecologist (SCE), The Ecological Society of America, 2020
Professional Wetland Scientist (PWS), Society of Wetland Scientists (No. 2639), 2016
Audubon Master Birder (AMB), Audubon Society of Greater Denver, 2016
38-Hour USACE Wetland Delineation Training
TxDOT Precertified, ESN 26686

Software

ArcGIS 10
Trimble R1 and DHA GPS Receivers
Garmin GPS
Microsoft Office
Adobe Acrobat
Bluebeam

Keith Hidalgo has 21 years of experience in the environmental industry, including performing specialized services under the National Environmental Policy Act (NEPA), Section 7 of the Endangered Species Act (habitat assessments, reports, biological assessments, biological opinions, programmatic biological opinions, append to request forms, etc.), the Clean Water Act Section 404 requirements (wetlands analysis, reports, and permit requests to US Army Corps of Engineers [USACE]), resource analysis for environmental impact statements, environmental assessments, and categorical exclusions. He has past experience performing wildlife crossing structure location analysis and siting of structures for the Colorado Department of Transportation and La Plata County in Colorado. Mr. Hidalgo manages biologists and other subject matter experts (SME) as the AtkinsRéalis EcoSciences Western Lead and is a Project Manager and Environmental Lead on various projects in Nevada, specifically in NDOT Districts 1 and 2 for NDOT, Clark County Regional Flood Control District, Clark County Public Works, City of Las Vegas, City of Henderson, Nye County, City of Reno, and the Washoe Regional Transportation Commission.

Mr. Hidalgo's AtkinsRéalis project experience includes:

I-15 North (Speedway to Garnet) Phase 3, NDOT, Las Vegas, NV. Biological resources lead for the NEPA and design of the I-15 improvements project from Speedway Boulevard to US 93/Garnet Interchange. Project manager for Environmental Services During Construction (ESDC). AtkinsRéalis provided environmental support to NDOT in the development of the NEPA document for the project. The project team provided field surveys (desert tortoise, Las Vegas bearpoppy, noxious weeds, cactus\yucca, migratory birds), mapping, impact evaluations, and mitigation needs for biological and cultural resources. Keith is currently managing environmental biological monitoring and inspection services during the construction of the project which includes clearance surveys for desert tortoise, daily construction monitoring, fence inspections, Las Vegas Bearpoppy (LVBP) mitigation, noxious weed spraying for LVBP, shade structure installation, cactus\yucca mitigation, and night work.

I-15 Truck Climbing Lanes Improvement Project, NDOT, Las Vegas, NV. Biological resources lead for the NEPA and design of the I-15 Truck Climbing Lanes Project, which included two climbing lane highway segments (Mile Post [MP] 64.4 to MP 66.1 and MP 71.9 to MP 70.7). AtkinsRéalis provided environmental support to NDOT in the development of the NEPA document for the project. The project team provided field surveys (desert tortoise, Las Vegas bearpoppy, noxious weeds, cactus\yucca, migratory birds), mapping, impact evaluations, and mitigation needs for the biological and cultural resources.

Reimagine Boulder Highway Corridor Design, City of Henderson, NV. Biological resources lead responsible for providing technical documentation for the NEPA document for roadway improvements to this corridor within Henderson, Nevada. AtkinsRéalis is designing improvements to 7.5 miles of Boulder Highway to address safety concerns, enhance mobility, include technology advancements, and add center-running transit. The project will convert a section of the highway into a complete street roadway, including altering the current six-lane highway into a four-lane highway with two dedicated bus lanes and a protected bike lane. This project

was selected for an Infrastructure for Rebuilding America (INFRA) grant application because it supports economic vitality through safety improvements along the Boulder Highway corridor and it is partially located in several Federal Opportunity Zones. Keith managed staff conducting biological and aquatic resource surveys (federal and state-listed species, wetlands, other waters, migratory birds, noxious weeds, cactus\yucca, rare plants).

Sparks Boulevard Improvements, Regional Transportation Commission of Washoe County, Sparks, NV. The biological resources lead is responsible for providing resource surveys for the Environmental Assessment and a Categorical Exclusion of the Sparks Boulevard corridor from north of Baring Boulevard south to East Greg Street. The purpose of the project is to widen the corridor for additional travel lanes and turning lanes and provide safety improvements and stormwater improvements. Provided technical reporting for biological resources and jurisdictional wetlands and other waters of the U.S. and is in the process of supporting 401 and 404 permitting.

Boynton Channel Stabilization, City of Reno, NV. Senior environmental scientist/biological resources specialist responsible for supporting resources surveys of the Boynton Slough/Dry Creek reaches the southeastern corner of the Reno-Tahoe International Airport. The purpose of the project is to conduct emergency design and improvements to the channel in areas where erosion risks the security of the airport, including the perimeter road and fence of the airport. Provided technical reporting for biological resources and jurisdictional wetlands and other Waters of the U.S. and is in the process of supporting 401 and 404 permitting.

Naples Channel/Airport Peaking Basin, City of Las Vegas, NV. Senior environmental scientist/biological resources specialist responsible for providing technical documentation under Clark County Regional Flood Control District's (CCRFCD) Section 8 Resource Screening Analysis, worked through Nevada Division of Environmental Protection's new 401 Water Quality Certification process, and Section 404 permitting under CCRFCD's regional general permit. Keith also supported agency coordination meetings to facilitate obtaining permits. The purpose of the project is to facilitate excessive stormwater flows, reduce flooding, and improve water quality in a built-out environment.

Professional development

FACWet Certification, CDOT
Extension Native Plant Master Program, Colorado Flora Certificate, CSU
Mapping with Mobile GIS Software, Trimble Certification
ACEC-CO Future Leaders 20-Hour Basic Supervisory Skills
Sedges of Colorado: Advanced Workshop and Field Trip, Rocky Mountain Biological Laboratory, Gothic, CO, 2015
Wildlife Crossing Level 1 - Planning, Design, and Construction, Metropolitan State College of Denver and Colorado Department of Transportation, 2007

Matthew Nussbaumer, PE, WRS

Principal Investigator

Matthew Nussbaumer brings 28 years of progressively responsible transportation experience with an emphasis on water resources and drainage design. His transportation projects have involved coordinating with multiple stakeholders across Nevada including federal, state, county, and general improvement districts. This allowed him to become familiar with many local issues as well as local/regional drainage manuals and their standard plans/specifications.

Specific stormwater design experience includes projects with concrete and riprap channels, energy dissipators, detention/water quality basins, storm drains, culverts, and erosion control and water quality improvements. Mr. Nussbaumer successfully managed the NDOT Lake Tahoe TMDL Program for 12 years, which was a stormwater master planning effort that led to the design, permitting, and implementation of water quality and erosion control projects in the environmentally sensitive Lake Tahoe Basin. In addition, advanced maintenance practices were developed and delivered through considerable coordination with a local maintenance forces and a wide range of stakeholders including regulators. Mr. Nussbaumer has experience delivering projects utilizing all three of NDOT's delivery methods, including design-bid-build, design-build, and construction manager at risk.

Mr. Nussbaumer's AtkinsRéalis project experience includes:

I-15 North Southbound Truck Climbing Lanes, Nevada Department of Transportation (NDOT), Las Vegas, NV. Drainage tasks lead responsible for all aspects of the drainage design. The project involves southbound median widening at two locations to establish and accommodate additional mainline lanes to be used for truck climbing purposes. As southbound I-15 is widened to the median to make width for the truck climbing lane to the outside, a new median ditch flow line is being re-established and new drop inlets will be placed to perpetuate median drainage. Extended a large quadruple 10- by 6-foot reinforced concrete box (RCB). Accounted for traversable slopes with the appropriate roadside design, drainage, landscape, and desert tortoise end treatments.

Sky Vista Parkway Widening and Rehabilitation, Regional Transportation Commission of Washoe County (RTC), Reno, NV. Drainage tasks lead responsible for all aspects of the drainage design. The project involves widening Sky Vista Blvd in a narrow right-of-way corridor that is surrounded by active development. Project drainage improvements will include storm drain upgrades and expansion, outfall stabilization, utility conflict coordination, and mitigation of stormwater volume increases because of the project's increased impervious area. The project is in the Lemmon Valley/Swan Lake hydrographic basin which ultimately drains to the Swan Lake Playa. Swan Lake has recently experienced considerable long-duration localized flooding. Due to the narrow right-of-way corridor, it will be necessary to mitigate the volume increase outside of the project limits.

Sparks Boulevard Corridor Widening Design Services, RTC, Sparks, NV. Serving as the drainage task lead responsible for all aspects of the drainage design. The project involves widening Sparks Blvd in a narrow right-of-way corridor that also includes the North Truckee Drain, The NTD and its surrounding banks are classified as Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA) Zone A. The drainage improvements to support the roadway capacity

Total years of experience

28

Years with firm

3

Education

B.S., Civil Engineering, University of Nevada, Reno, 1994

Registrations/licenses

Professional Engineer
Nevada 014450, 2000

Certifications

Water Rights Surveyor, Nevada 1180, 2001

Software

HEC-RAS
HEC-HMS
WSPG
HY8
FHWA Hydraulic Toolbox
MicroStation and Inroads

Professional development

Stream Stability and Scour at Highway Bridges, FHWA-NHI
HEC-HMS Short Course, West Consultants
SHRP2 R10 Project Management Strategies for Complex Projects, FHWA
Practical Highway Hydrology, FHWA, HHI

improvements will include an extension of existing culverts and the upgrade and reconfiguration of existing on-site storm drain systems, outfall stabilization, utility conflict coordination.

Hydrologic Criteria Drainage Design Manual Update (HCDDM), Clark County Regional Flood Control District, Las Vegas, NV. Senior engineer assisting with the review and update of the HCDDM. The HCDDM was last updated in 1999 and was due for an update. The HCDDM will be updated to correct discrepancies, incorporate feedback from stakeholders, including updates to text, criteria, formulas, equations, charts, and/or diagrams based on updated reference material, and improve the clarity and usability of the HCDDM. A working group was formed to solicit feedback, comments, and desired updates from representative users. I am responsible for the update of assigned sections and assisting with the overall manual review. This will be accomplished by literature and technical reviews and proposing updates to the stakeholder working group. Once the updates are agreed upon, the changes and updates will be incorporated into a final, updated HCDDM.

Hydrologic Modeling with Watershed Modeling System (WMS), FHWA-NHI
River Engineering for Highway Encroachments, FHWA-NHI
HEC-HMS, Floodplain Management Association
HEC-RAS, Floodplain Management Association
Urban Drainage Design w/ Pumping Station Design, FHWA, NHI

Nathan Wood

Authorized Desert Tortoise Biologist

Nathan Wood has 15 years of biological and environmental field survey experience involving protected species and habitats, with subsequent completion of technical reports and input in planning documents for a range of projects for large infrastructure improvements and engineering companies in the United States and the United Kingdom. He has worked alongside organizations of national and international importance on a range of conservation and ecological projects in numerous global locations. His responsibilities have included environmental and biological data collection; field survey and radio telemetry of Mojave Desert tortoise; bird and bat mortality field surveys; construction monitoring; planning and conducting baseline biological surveys; technical reporting and planning documents; leading, managing, and organizing teams; database design, analysis, and management; health and safety policies and procedures; animal handling; and use of field equipment (tablets, GPS).

Mr. Wood's AtkinsRéalis project experience includes:

I-15 North Phase 3 (Speedway to Garnet), NDOT, Las Vegas, NV. Ecologist responsible for monitoring construction activities to ensure compliance with permits and the protection of species at state and federal levels, with subsequent report submission. The project involves road widening with approximately 10.67 miles of right-of-way and a borrow site. To accommodate projected local traffic, decrease congestion, reduce travel times, and improve access and safety, the project will consist of capacity improvements, truck parking, and minor traffic enforcement elements. Work includes inspecting major ground disturbances, night work, weekend work, and daily work and training to keep the project on schedule and to mitigate risks during construction.

Beatty Airport Capital Improvement Project (Automated Weather Observation System), Beatty, Nye County, NV. Desert Tortoise Biologist. Ecologist operated as an Authorized Desert Tortoise Biologist, responsible for monitoring construction activities to ensure compliance with permits and relevant Biological Opinion to ensure the protection of the Mojave Desert Tortoise. Responsible Party for NDOW Special Purpose Permit. The project involves six individual projects until 2027, with the current project requiring the construction and installation of an Automated Weather Observation System components. Nathan actively monitored the project to mitigate risks to species while installation of the utility line to power the AWOS system.

South Boulevard 2745 Zone Reservoir and 2975 Zone Pumping Station, Las Vegas Water District, Las Vegas, NV. Desert Tortoise Biologist. Ecologist conducted a biological resource survey that comprised desktop review and field survey for threatened and endangered species, including investigation of the study area for any presence or signs of Mojave Desert Tortoise. The project consisted of the construction of a reservoir and pumping station and associated works to provide additional capacity to support the existing and proposed development.

Total years of experience

15

Years with firm

2

Education

M.Sc., Conservation Biology, Manchester Metropolitan University, 2010

B.Sc., Environmental Science, University of East Anglia, 2003

Certification

Authorized Desert Tortoise Biologist by the USFWS

Software

Microsoft Office
Esri ArcGIS Desktop 10.8.1

Mr. Wood's project experience before joining AtkinsRéalis included:

Multiple Projects, Various Clients, Southern NV, and Northwest AZ. Assistant staff biologist. Assisted with field surveys in Nevada and Arizona for preconstruction surveys for Mojave Desert tortoise for renewable solar project, baseline field surveys for mining exploration, construction monitoring, post-construction surveys for bat and avian fatalities on a 126-turbine windfarm, and native plant (cacti) translocation.

Mojave Desert Tortoise Surveys, Las Vegas, NV. Biologist. Assisted with Mojave Desert Tortoise surveys for a 7-mile proposed transmission line using GPS units to record locations of protected species.

Mojave Desert Tortoise Surveys, Las Vegas, NV. Field biologist. Assisted with Mojave Desert Tortoise surveys on a Bureau of Land Management (BLM) site covering 5,000 acres.

Multiple Projects, Various Clients, Manchester, United Kingdom. Ecologist. Worked on more than 20 projects including large-scale road schemes, river restoration, flood alleviation developments, bridge infilling, and culvert replacements. Conducted baseline surveys (Phase 1) including desk-based research and coordinated and led field surveys (presence/absence, species diversity, and population abundance surveys) for protected habitats and species (plants, mammals, birds, reptiles, and amphibians). Wrote risk assessments, method statements, environmental scoping reports, feasibility reports, protected species technical reports, environmental impact assessments, and environmental statements.

Froglife, Bedford, United Kingdom. Field worker. Assisted with large-scale trapping of over-protected species of amphibians and reptiles with subsequent translocation of the animals to the receptor site. More than 5,000 individuals were relocated from a disused quarry site 1 kilometer in size using 2,500 pitfall traps along 13 kilometers of fence line.

Thomson Ecology, United Kingdom (various locations). Field surveyor. Surveyed for protected amphibian species on several projects relating to proposed power line developments.

Durrell Wildlife Conservation Trust, Saint Lucia. Field assistant. Involved in several projects including invasive non-native species control, metapopulation management, sustainable livelihoods, protected species surveys, and habitat assessments.

Wildlife Trust, Bedfordshire, United Kingdom. Volunteer officer. Primarily responsible for woodland, heathland, and grassland habitat management throughout 15 reserves. Other tasks included providing reserve maintenance (access improvements including installation of gates, fences, and signs); assisting with running weekly volunteer work events; and providing livestock management. Achieved the development of newly acquired land into a new reserve including installation of interpretation boards.

Limpopo Ecological Operators, South Africa. Wildlife research volunteer responsible for assisting with a long-term monitoring project that studied carrying capacity and population impact on a reserve by daily radio tracking of a lion pride. Recorded distribution and population data for all other species within the reserve.

Nathaniel Yost, AWB

Authorized Desert Tortoise Biologist

Nathaniel Yost has experience in environmental science as a biological monitor, including monitoring Mojave Desert tortoises. Nathaniel previously worked for the U.S. Geological Survey to track radio-transmitted desert tortoises; handled desert tortoises to collect morphological measurements; added and changed transmitters and GPS loggers; and monitored epicoelomoic rehydration. He has collected data through project datasheets and electronic platforms iForm, FieldMaps, and Collector and conducted desert tortoise surveys using Garmin 64s GPS and established line-distance transect protocol. In addition, he has identified Mojave Desert plant species using guides and dichotomous keys and monitored construction projects under federal biological opinions in the Mojave Desert.

Mr. Yost's AtkinsRéalis project experience includes:

Reimagine Boulder Highway Project, National Environmental Policy Act (NEPA) Task Order, City of Henderson, NV. Environmental scientist responsible for biological resources and threatened and endangered species. AtkinsRéalis is providing the City of Henderson with guidance for NEPA coordination and environmental resource evaluation. We are assisting with interfacing with coordinating agencies RTC, NDOT, and FHWA on all NEPA and permitting/stewardship agreement activities, ensuring transit standards for center running bus rapid transit are met, assisting with targeted stakeholder outreach, coordinating with Regional Flood Control District, and preparing NEPA documentation of a categorical exclusion for COH, with additional reviews by RTC, NDOT, and FHWA.

Cadence Sports Park Storm Drain 401 and 404 Permitting Services, The LandWell Company, Henderson, NV. Environmental scientist. AtkinsRéalis is assisting The LandWell Company in addressing the potential need for obtaining a Clean Water Act Section 401 Water Quality Certification from the Nevada Department of Environmental Protection and a CWA Section 404 nationwide permit for impacts to wetlands and other Waters of the U.S. (WOUS) from the U.S. Army Corps of Engineers. Permits are required when projects will impact WOUS, including ephemeral washes that drain into known Relatively Permanent Waters.

I-15 North Phase 3, Speedway to Garnet, NDOT, Las Vegas, NV. Environmental scientist responsible for providing environmental services during the construction phase. AtkinsRéalis is completing the environmental construction monitoring tasks and fulfilling permit requirements for rare plants and Desert tortoises. The scope includes monitoring construction activities for impacts on Desert tortoise, migratory birds, noxious weeds, rare plants, and cactus/yucca; conducting tortoise clearance surveys; reporting Las Vegas Bearpoppy; conducting migratory bird surveys; installing Desert tortoise shade structures; managing noxious weeds; providing inventory and flagging cacti/yucca.

Mr. Yost's project experience before joining AtkinsRéalis included:

U.S. Geological Survey Western Ecological Research Center, Henderson, NV. Biological science technician. Conducted desert tortoise ecology training and research for juvenile and adult Mojave Desert tortoises and their habitats. Conducted tortoise sign surveys, tortoise handling, marking, attachment, and removal of radio

Total years of experience

7

Years with firm

1

Education

M.S., Fisheries and Wildlife, Michigan State University, 2020

B.S., Wildlife Ecology, University of Wisconsin, Stevens Point, 2017

Certifications

Associate Wildlife Biologist (AWB), The Wildlife Society
Authorized Desert Tortoise Biologist
USFWS Permit: Mojave Desert Tortoise (*Gopherus agassizii*), TE-63428D-0, 2022

Professional Affiliations

The Wildlife Society

Software

Microsoft Word and Excel
GIS

Professional development

Structured Demographic Models for Population, Community, and Evolutionary Ecology, 2018
Costa Rica: Tropical Ecology, 2017
WSP College of Natural Resources Field Techniques in Natural Resources, 2015

transmitters, assessment of clinical health, measurements of mass and shell length, and rehydration. **Duration:** 11/2021-10/2022

Line 2000/3000/4000, SoCalGas Pipeline System, San Bernardino County, CA. Approved biological monitor. Monitored the presence and status of Mojave Desert tortoises along various construction pipelines and project fences within San Bernardino County for SoCalGas. Conducted field surveys to locate tortoise signs and live tortoises within project boundaries and ensured compliance with project biological opinions under Section 7 – Endangered Species Act (ESA).

Jean-Primm Highway Project, Nevada Department of Transportation, Clark County, NV. Biological monitor. Monitored the presence and status of Mojave Desert tortoises along highway construction and project fences in Clark County. Conducted field surveys to locate tortoise signs and live tortoises within the project boundary and ensured compliance with project biological opinions under Section 7 – ESA.

Gemini Solar Project, Solar Partners XI, Clark County, NV. Biological monitor. Monitored the presence and status of Mojave Desert tortoises along the construction of solar field and project fence in Clark County. Conducted field surveys to locate tortoise signs and live tortoises within the project boundary and ensured compliance with project biological opinions under Section 7 – ESA.

Clark H. Barlow, PE, CFM

Technical Advisor

Clark Barlow has 17 years of experience providing hydrologic and hydraulic analysis and project management duties on water resources, transportation, and sanitary sewer projects and is recognized nationally as AtkinsRéalis technology and innovation lead for water resources. Mr. Barlow has served as the project manager for several flood control master plan updates across Clark County. He has also served as the drainage lead for several flood control projects including a levee design project on the Virgin River, the Mesa Boulevard Flood Control Channel in Mesquite, and Las Vegas Wash Improvements for a new bridge at Desert Inn Road. Mr. Barlow has performed studies involving advanced hydrologic and hydraulic analysis for many different applications and using a variety of different 1D and 2D models. He has also conducted more than 20 training courses on the topic of hydrologic and hydraulic modeling across nine states and six countries and has presented at national conferences on the topic of advanced hydrodynamic modeling.

Mr. Barlow's AtkinsRéalis project experience includes:

Lower Las Vegas Wash Stabilization Program, Southern Nevada Water Authority, Las Vegas, NV. Project engineer responsible for hydrologic and hydraulic analysis and sediment transport analysis. The purpose of the program is to protect existing infrastructure by slowing and preventing channel degradation through the construction of new grade control structures on the Lower Las Vegas Wash in the Lake Mead National Recreation Area, improving the water quality of the lake. As part of the first task order for the program, AtkinsRéalis is providing overall planning services in support of weirs 1 through 10 including project management, overall system hydraulics and hydrology, overall system access roads, environmental support, and planning/conceptual design of weirs (repairs to existing weirs and construction of new weirs), access roadway preliminary and final design, and design support during construction. Clark oversaw the advanced 2D and 3D modeling that was utilized in analyzing the selected alternative for the first weir structure to verify hydraulic function and stability for large runoff events.

High Hazard Dam Emergency Action Plan Updates, City of North Las Vegas, NV. Hydrologist/project manager responsible for developing and updating EAPs for all 6 high-hazard dams/diversion dikes within the City of North Las Vegas. Project work included hydrologic analysis, hydraulic analysis using two-dimensional dam breach models, inundation mapping, notification and response protocols, decision flow charts, evacuation planning and critical facility identification, stakeholder outreach, and meeting all regulatory requirements with the State of Nevada Dam Safety Office.

2023 Las Vegas Valley Flood Control Master Plan Update, Clark County, NV. Hydrologist/project manager responsible for all aspects of delivery including data collection, development of GIS framework, hydrology, facility planning, environmental considerations, cost estimating, and plan/report development over a 1,600 square mile combined watershed area that includes the cities of Las Vegas, Henderson, North Las Vegas, and parts of unincorporated Clark County. The analysis includes more than 110 detention/debris basins and over 790 miles of conveyance facilities, including 13 miles of levees.

Total years of experience

17

Years with firm

8

Education

M.S., Civil Engineering, Brigham Young University, 2007

B.S., Civil Engineering, Brigham Young University, 2006

Registrations/licenses

Professional Engineer
Nevada 023743, 2015
Utah 7764838-2202, 2010

Certifications

Certified Floodplain Manager (CFM), US-10-05431

Professional Affiliations

Floodplain Management Association, Professional Development Committee Chair

Software

MODRAT, OC Rational, OC Unit Hydrograph, SWMM, XPSWMM, HEC-RAS, HEC-RAS 2D, SRH-2D, TUFLOW, AdH, CMS-Flow, CMS-Wave, ADCIRC, HEC-1, HEC-HMS, GSSHA, WMS, SMS, ArcGIS

Hydrologic Criteria and Drainage Design Manual Update, Regional Flood Control District, Clark County, NV. Technical director for the first comprehensive update of the 650-page drainage design manual in 20 years. Updating technical criteria on all aspects of drainage design including drainage policy, rainfall, runoff, open channel hydraulics, storm drain hydraulics, streets, culverts, additional hydraulic structures, detention basins, sediment and erosion, alluvial fans, and structural best management practices (BMP).

Technical Support Services for Preparation of Flood Control Master Plan Updates, Regional Flood Control District, Clark County, NV. Project manager responsible for hydrologic analysis/comparisons, facility sizing, and report review in support of District-led updates of Muddy River (2020), City of Mesquite and Town of Bunkerville (2021), and Boulder City (2020) MPUs.

Summerlin Village 13 West Master Engineering Support Studies, Summerlin Development, Las Vegas, NV. The engineer responsible for performing existing and proposed condition hydrologic analysis and developing a conceptual drainage plan. AtkinsRéalis is updating this master plan to allow for high-density residential, mixed-use, and a stadium within the heart of the Summerlin master-planned community.

Bermuda Phase 1 Sewer Main Design and Phase 2 Sanitary Sewer Preliminary Engineering Services, City of Henderson, NV. Serves as a senior engineer. AtkinsRéalis is providing permitting and design services related to establishing an offsite sanitary sewer main that will provide service to a proposed school site.

2019 Outlying Areas Master Plan Update, Regional Flood Control District, NV. Project manager responsible for the update of hydrologic and hydraulic models and the development of a comprehensive flood control master plan for Jean and Coyote Springs, within unincorporated Clark County.

Flamingo Diversion Channel - Rainbow Branch, Clark County Public Works, Clark County, NV. Project engineer responsible for supporting hydrologic and hydraulic (H&H) analysis, storm drain design, letter of map revision (LOMR), and utility relocations. AtkinsRéalis provided design engineering and H&H analyses for the regional storm drain facility located on Rainbow Boulevard from Sunset Road to Russell Road. The project included 2,820 linear feet of 12- by 4-foot reinforced concrete box (RCB), 2,460 linear feet of 12- by 6-foot RCB, and 3,260 linear feet of lateral storm drains ranging in size from 24-inch reinforced concrete pipe to 6- by 4-foot RCB. The project also included drop inlets, headwalls, junction structures, transition structures, 1,040 linear feet of new 12-inch sewer line, 500 linear feet of 12-inch water line relocation, and other utility relocations. This project won the APWA Nevada Chapter 2018 Project of the Year for Environmental valued between $10 million and $20 million (Fall Conference).

FEMA Risk MAP Production and Technical Services Contract (PTS-2) Regions 2, 5, 7, 9, and 10. Hydrologist/Hydraulic Engineer/Project Manager: H&H Lead for 66 square miles of detailed hydrology and 23 miles of detailed 1D/2D hydraulic modeling within highly urbanized Orange County (CA). Modeling was for FEMA flood risk data for regulatory and no-regulatory products and data. Lead H&H Modeler for the Compton Creek and Dominguez Channel Flood Risk Mitigation Alternatives Study that evaluated strategies for reducing flood risk on a watershed scale within Los Angeles County.

Professional development

Primary Instructor, NHI Training Course 135080 on Hydrologic Analysis and Design with the Watershed Modeling System, 2007-2014
Co-Instructor for SMS/AdH Training, Los Angeles County Department of Public Works, 2012
Instructor, WMS Training Course, City of Los Angeles Bureau of Engineering, 2011
Instructor, FHWA 2010 Webinar Series on Hydrologic and Hydraulic Modeling using WMS and SMS, 2010

Mark Elkouz, Ph.D., PE

Research H&H Modeling and Design

Dr. Mark Elkouz's water resources engineering experience involves working with H&H modeling, master conceptual drainage studies, roadway drainage analysis, and technical, and other drainage-related work. He has worked on projects in various jurisdictions in the Las Vegas Valley for public and private clients. Before AtkinsRéalis, Mark performed research and completed advanced studies, tutoring, and instruction in civil and environmental engineering topics at the University of Nevada, Las Vegas (UNLV), and assisted with research at the Las Vegas Valley Water District's (LVVWD) River Mountain Water Treatment Facility's Applied Water Quality Research Laboratory. His areas of focus included materials testing, water treatment processes, groundwater remediation, water/wastewater treatment, and stormwater runoff treatment.

Dr. Elkouz's AtkinsRéalis project experience includes:

Hydrologic Criteria and Drainage Design Manual Update, Regional Flood Control District, Clark County, NV. Project engineer for the first comprehensive update of the 650-page drainage design manual in 20 years. Updating technical criteria on all aspects of drainage design including channel stabilization, scour, sediment transport, hydraulic modeling, and erosion control structures.

Horizon Lateral Preliminary Design Services (South System Expansion), Southern Nevada Water Authority (SNWA), Henderson, NV. Project engineer. Following a feasibility study performed by SNWA, AtkinsRéalis, as a subconsultant, provided design services during construction for the design and construction of the Horizon Lateral project, which is a new 375-mgd potable water conveyance system.

Charleston/Maryland Storm Drain Final Design, City of Las Vegas, NV. Senior engineer supporting final design of approximately 15,000 linear feet of storm drain. This is the largest and most complex storm drain project ever undertaken by the City of Las Vegas with an overall construction cost of more than $60 million. AtkinsRéalis is the lead design engineer. This project is Phase 2 of the overall Boulder Highway Storm Drain system, which connects to Phase 1 (also designed by AtkinsRéalis).

Boulder Highway Storm Drain, City of Las Vegas, NV. Project engineer responsible for hydrology and hydraulic modeling for the design of new flood control facilities along Boulder Highway from Sahara Avenue to Charleston Boulevard. The proposed facility will tie into the existing county facility by Sahara Avenue. The project also includes other storm drain improvements along St. Louis Avenue, Oakey Boulevard, and Olive Street, tying into the proposed boxes along Boulder Highway.

Hydrologic Criteria and Drainage Design Manual Update Services, Regional Flood Control District, Clark County, NV. Project engineer. Worked as part of a team on various parts of the project including verification of manual information, discussion/development of certain topics, comment responses, work on examples/exhibits and calculations, and participation in meetings.

Total years of experience

14

Years with firm

4

Education

Ph.D., Civil and Environmental Engineering, University of Nevada, Las Vegas, 2019

M.S., Civil and Environmental Engineering, University of Nevada, Las Vegas, 2014

B.S., Civil and Environmental Engineering, University of Nevada, Las Vegas, 2010

Registrations/licenses

Professional Engineer:
Nevada 029461, 2021

Honors and awards

Magna Cum Laude, University of Nevada, Las Vegas, NV, 2010
Outstanding Graduating Senior in Civil and Environmental Engineering Award, Las Vegas, NV, 2010

Professional Affiliations

Tau Beta Pi, The Engineering Honor Society
Water Environment FederationAmerican Society of Civil Engineers, Associate Member; Board Member, Nevada Section, Younger Member Forum

Summerlin West Villages 27, 30A, and 31 Grand Park Drainage Basin Master Conceptual Drainage Study Services, Summerlin Development, LLC, Clark County, NV. Project engineer. Responsible for hydrologic calculations, subbasin delineation, and hydrologic modeling in HEC-1. Provided preliminary storm drain modeling in FlowMaster. Prepared reports and report materials. The project was the master conceptual drainage study for an undeveloped area in Summerlin. The project tied into an existing downstream storm drain system, so it was necessary to manage the flows in such a way as to not surpass the allowable downstream capacity.

Clark County Valley-wide Metal Gravity Pipe Replacement Project, CCWRD, Clark County, NV. Project engineer. Worked as part of a team on various tasks, including reviewing CCTV of sewer lines for information on laterals and damage, analyzing the community impacts of the proposed work, reviewing as-builts, and the status of comments, etc. as well as preparing a technical memorandum for the 90% design. This project involved the evaluation and design for repair/replacement of damaged metal sewer pipes across the Las Vegas Valley. The repair consisted of cured-in-place-pipe improvement methods to minimize labor, site impacts, and costs for the client.

Cadence Sewer Lift Station Design Services, D. R. Horton, Henderson, NV. Project engineer. Prepared all H&H calculations, which included the delineation of subbasins, calculation of flows, and modeling of drainage swales. Prepared an entire report for a senior engineer. This technical drainage study investigated the interim drainage conditions for a proposed sewer lift station. Swales were proposed/investigated, to protect the site from floodwaters.

Centennial Parkway (Pecos Road to Lamb Boulevard) Improvements Design Services/Centennial Parkway Final Design, City of North Las Vegas, NV. Project engineer. Responsible for all aspects of the hydrologic modeling (subbasin delineation, calculation of parameters, and HEC-1 modeling) as well as all hydraulic modeling (calculation of inlet collection using FlowMaster and storm drain capacity, using WSPG). Prepared exhibits and reports, bringing the project to the 60% level of design. The project is in a developed/developing area and existing flow conditions were considered, in addition to relevant nearby developing areas. Very mild roadway slopes and multiple roadway low points brought about the need for increased hydraulic modeling of the storm drain and larger proposed storm drain sizes.

Boulder Highway Preliminary Design Services, City of Henderson, Henderson, NV. Project engineer. Responsible for updating and refining the previous hydrology and storm drain layout of this roughly 7-mile stretch of urban highway and bringing it to the 30% level of design. The work considered drainage for two independent traffic directions as well as a central bus rapid transit lane. Taking advantage of existing infrastructure to minimize costs was also a key consideration.

Software

ArcGIS
AutoCAD
Autodesk Storm and Sanitary-Analysis
BIM 360
Bluebeam Revu
EPANET
Flowmaster
HEC-1
HEC-RAS
Microsoft Office
R
Stella
Water Surface and Pressure Gradient (WSPGW/WSPG-10)

Professional development

Professional Development Panel – Professional Development During COVID-19, ASCE, Nevada Section, Southern Branch, Younger Member Forum, Las Vegas, Nevada (6/17/2021).

Professional Development Panel – Negotiation Skills, ASCE, Nevada Section, Southern Branch, Younger Member Forum, Las Vegas, Nevada (07/16/2020).

Brett Jefferson, PLS, WRS

Public Land Surveyor

Total years of experience

45

Years with firm

1

Education

A.S., Surveying and Drafting, Community College of Denver, 1987

Registrations/licenses

Professional Land Surveyor (PLS)
- Arizona 27243, 1993
- California 6267, 1990
- Nevada 008421, 1989

Certifications

Water Rights Surveyor, Nevada, 1019

Honors and awards

Special Contribution Award for Foresights CSUF Student Publications, 1989
Excellence in Professional Journalism Award, American Congress on Surveying and Mapping/National Society of Professional Surveyors, 1992
Surveyor of the Year Award Nevada Association of Land Surveyors, 1996
Meritorious Service Award Southern Nevada Chapter NALS, 1998
Key Governor Award – National Society of Professional Surveyors, 2001
Professional Service Award, Nevada

Brett Jefferson has 45 years of professional licensed land surveying experience as a project manager and project surveyor experience involving boundary and route surveying, GPS surveying, cartography and mapping, geodesy and geodetic surveying, cadastral surveying, construction surveying for public works projects, aerial photogrammetry, right-of-way mapping, expert consultant, and witness, and as a land surveying instructor.

Mr. Jefferson's AtkinsRéalis project experience includes:

Backflow Retrofit Program Right-of-Way and Survey Support Services, Las Vegas Valley Water District, Las Vegas, NV. Senior surveyor responsible for providing necessary surveying and field tasks. AtkinsRéalis is providing surveying and right-of-way services, including drafting legal descriptions, for the installation of approximately 12,800 backflow devices at existing meters.

Sky Vista Parkway (Lemmon Drive to Silver Lake Road) Widening Design Services, Regional Transportation Commission of Washoe County, Reno, NV. Senior surveyor responsible for providing necessary surveying and field tasks. AtkinsRéalis is designing the widening of Sky Vista Parkway from and including the Vista Knoll Parkway intersection to and including the Silver Lake Road intersection. Improvements include reconstructing and widening the existing two-lane roadway to include four lanes with a raised median; dedicated left turn lanes; dedicated right turn lanes where necessary; new curb, gutter, and sidewalk along both sides of the roadway; bicycle lanes; pedestrian ramps; traffic signal infrastructure; utility adjustments; grading; and drainage improvements. The intersections along Sky Vista Parkway will be reconfigured and reconstructed to accommodate the widened roadway section. Multiple existing and future development access locations including the North Valleys Regional Park will also be reconfigured and reconstructed to accommodate the widened roadway section.

Mr. Jefferson’s project experience before joining AtkinsRéalis included:

Group 876 Township 40 North, Range 51 East, MDM, Dependent Resurvey and Corrective Dependent Resurvey, Bureau of Land Management, Tuscarora, Nevada, NV. Cadastral surveyor responsible for dependent resurvey and corrective dependent survey of Township 40 N., Range 51 E., M.D.M., Nevada. The project involved a dependent resurvey of the Eight Standard Parallel North, through Range 51 East and a portion of Range 52 East, the corrective dependent resurvey of a portion of the west boundary, and the dependent resurvey of a portion of the subdivisional lines and portions of certain mineral surveys designated to restore the corners in their true original locations according to the best available evidence. The plat also shows amended lottings created by the segregation of lode mining claims and mineral surveys.

Laughlin Bridge from Needles Highway to Bullhead City Parkway, Clark County Public Works, Laughlin, NV. Project surveyor responsible for all surveying and mapping services and deliverables. The project involved a geodetic control survey network extending from Needles Highway in Nevada to US Highway 93 in Arizona. Developed coefficients for projecting state plane coordinates to ground equivalent values. Performed aerial ground control survey, aerial photogrammetric

topographic mapping and digital orthophotography, research, retrace public lands sections, Fort Mohave Indian Reservation Boundary, and portion of the state line between Nevada and Arizona. Established the proposed alignment and match connection retracement surveys. Provided right-of-way mapping and engineering design surveys and additional survey-related services.

Tropical Parkway from Hollywood Boulevard to Nicco Way, City of North Las Vegas, NV. Project surveyor responsible for all surveying and mapping services and deliverables. The project involved aerial ground control survey, aerial photogrammetric topographic mapping and digital orthophotography, research, alignments and subsectional aliquot part retracement surveys, right-of-way mapping, engineering design surveys, collecting utility surface and subsurface survey data, preparation and recordation of a record of survey – survey control plan for the project, setting missing controlling corners, as well as locating potholes performed by the subsurface utility engineers.

Hollywood Boulevard Storm Drain and Nellis Air Force Base Extension, City of North Las Vegas, NV. Project surveyor responsible for all surveying and mapping services and deliverables. The project involved verifying aerial ground control survey, aerial photogrammetric topographic mapping and digital orthophotography, research, alignments and subsectional aliquot part retracement surveys, right-of-way mapping, engineering design surveys, coordinating with Nellis Air Force Base for access, collecting utility surface and subsurface survey data, preparation and recordation of a record of survey – survey control plan for the project, setting missing controlling corners, as well as locating potholes performed by the subsurface utility engineers.

Alexander Road from Losee Road to North 5th Street, City of North Las Vegas, NV. Project surveyor responsible for all surveying and mapping services and deliverables. The project involved an aerial ground control survey, aerial photogrammetric topographic mapping and digital orthophotography, research, alignment and intersection streets retracement surveys, right-of-way mapping, engineering design surveys, collecting utility surface and subsurface survey data, preparation and recordation of a record of the survey – survey control plan for the project, setting missing controlling corners, as well as locating potholes performed by the subsurface utility engineers.

State Board of PE & PLS, 2001
Max-Q Award for Excellence in Leadership, 2002
Meritorious Service Award Nevada Association of Land Surveyors, 2006
Fellow - American Congress on Surveying and Mapping, 2008

Honorary appointments

Lab Instructor, Guest Class Speaker, and LSI & PLS Review Instructor, California State University, Fresno (1988 to 1990)
California State University, Fresno – Surveying Engineering Conference Chair, 1989
Editor of The California Surveyor 1989 through 1992
Nevada Professional Land Surveyors Exam Committee, 1993 to 2003
Director, Southern Nevada Chapter Nevada Association of Land Surveyors, 1992 and 1993
Education Chairperson, Southern Nevada Chapter NALS, 1992 - 1996
Chapter Treasurer, Southern Nevada Chapter Nevada Association of Land Surveyors, 1994
Chapter Secretary, Southern Nevada Chapter Nevada Association of Land Surveyors, 1995
Chairperson Nevada State Standards of Practice Committee for GPS and GIS, 1995 and 1996
Chairperson Nevada State Standards of Practice for Metrication, 1995 and 1996
Conference Committee Program Chairperson, NALS 1991, 1992, 1993, 1994, 1998, and 2000
Conference Committee Chairperson, NALS 1995, 1996, 1997, 1999, 2001, 2004, 2005, and 2006
Vice President, Southern Nevada Chapter Nevada Association of Land Surveyors, 1996
Chapter President, Southern Nevada Chapter Nevada Association of Land Surveyors, 1997
State Treasurer, Nevada Association of Land Surveyors, 1997
State Secretary, Nevada Association of Land Surveyors, 1998
Nevada Governor to National Society

Appendix B. PROJECT SCHEDULE

Task	Start Date	End Date	Duration
Project Kick off	April 1	April 8	1 week
Stakeholder Engagement	April 1	April 15	2 weeks
Culvert Selection	April 1	April 26	3 weeks
NDOT Review	April 29	May 10	2 weeks
ECA & Report	April 29	July 19	3 months
Survey & 30% Design	April 29	July 19	~ 3 months
NDOT 30% Design Review	July 22	August 16	~ 1 month
Design Criteria	July 19	Dec. 5	~ 5 months
60% Design	August 19	Sept. 27	~ 1 month
NDOT 60% Design Review	Sept. 30	October 25	~ 1 month
Final Design & Criteria	October 28	Dec. 6	~ 1 month
NDOT Final Review	Dec. 9	January 31, 2025	~ 2 months
Finalize PS&E, Report, & Criteria	February 3, 2025	February 21, 2025	~ 3 weeks
Final Submittal	February 24, 2025	February 24, 2025	1 day

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