

Mitigation Tools

Energy Policy Opportunity Map EPOM – on-line tool - <http://imap.mesacounty.us/epom/>

Mitigation Measures ¹

| Sensitivity | Mitigation Measure | Description | Recommended or Mandatory |
|---------------------------------------|---------------------------------|---|--------------------------|
| Visual, Transportation, Surface Water | Directional/Horizontal Drilling | <p>Directional/Horizontal Drilling allows for multiple wells to be drilled from a common well pad.</p> <ul style="list-style-type: none"> • Greatly reduces surface-related impacts by minimizing the number of well locations and surface equipment necessary to service greater volumes of production, especially when employed with Consolidated Production Facilities techniques. • The geology and target production zone determines which drilling technology (directional or horizontal) will be employed. • Both technologies mitigate surface-related impacts similarly. | RECOMMENDED |
| Visual, Transportation, Surface Water | Three-Phase Gathering | <p>Three-Phase Gathering allows for pipelines to be installed parallel to the natural gas gathering lines to take production liquids to centralized storage points rather than employ storage tanks at all well pad locations.</p> <ul style="list-style-type: none"> • Can be used in conjunction with Consolidated Production Facilities to minimize the amount of production surface equipment in various locations in a specific area. | RECOMMENDED |

¹ These mitigation measures are not all inclusive and should be kept current pursuant to GoalG10 and Policy 5 of this Plan.

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| Visual, Transportation | Consolidated Production Facilities | <p>Consolidated Production Facilities techniques consolidate production units and appurtenances on one well pad with common storage tanks.</p> <ul style="list-style-type: none"> • Largely employed when directional or horizontal drilling is used to complete multiple wells from a common well pad. • In certain circumstances, even directional well pads may be further consolidated with others to allow for a common production facility to service several well pads. | RECOMMENDED |
| Transportation, Odor, Noise, Visual, Surface Water | SCADA/Telemetry | <p>Supervisory Control and Data Acquisition (SCADA)/Telemetry systems are used to remotely monitor and/or control processes within facilities.</p> <ul style="list-style-type: none"> • Can be employed at production, gathering and processing facilities to minimize transportation impacts due to personnel needed for typical facility monitoring and control. • Allows for a rapid and remote response in the event of an adverse incident, minimizing potential impacts while protecting the community and potential emergency response or company personnel. • Field activities can be better planned and more efficient due to remote monitoring capabilities. • Communication with cell towers, satellites, and other transmitters may limit employing this technology. (NOTE: locating new cell towers may require a Conditional Use Permit) | RECOMMENDED |

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| Visual | Color Selection | <p>Color Selection of Equipment can mitigate visual impacts by blending in with the natural environment</p> <ul style="list-style-type: none"> • Limited to areas with low to moderate visual impact potential. • A minimum requirement for all drilling and conditional use permits to mitigate visual impacts in Mesa County. | MANDATORY minimum standard |
| Visual | Camouflage | <p>Camouflage techniques include, but are not limited to, constructing outbuilding structures around production or pipeline-related equipment to blend in with the predominantly rural/agricultural setting.</p> <ul style="list-style-type: none"> • Can be employed to minimize scenic impacts in highly sensitive visual resource areas. • Structures must be designed and built to not only conceal the equipment they are housing but to ensure that the materials used for the construction do not pose a fire or safety risk to personnel, the environment or community. | REQUIRES ON-SITE INSPECTION TO DETERMINE APPLICABILITY |
| Visual, Noise | Screening/Barriers | <p>Screening/Barriers include natural or constructed barriers to screen visibility of facilities and/or odor impacts.</p> <ul style="list-style-type: none"> • Employed in area with moderate to high sensitivity for visual or noise impacts. • May be most appropriate in locations when tied to Directional or Horizontal Drilling where surface locations can be located to account for topography and other variance in the landscape. | REQUIRES ON-SITE INSPECTION TO DETERMINE APPLICABILITY |

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| Odor, Visual, Air Quality, Wildfire, Noise | Flowback Units | <p>Flowback Units are used following the well enhancement or frac operations to remove water and frac sand from the production gas stream prior to tying the well into the gas gathering system.</p> <ul style="list-style-type: none"> • Eliminates the need for open flaring into a flare pit or equivalent. • Allows for the natural gas to be captured rather than vented or flared into the atmosphere. | RECOMMENDED |
| Ground Water, Surface Water | Frac Tracing | <p>Frac Tracing allows for the material used in the well frac operations to be traced to ensure that frac materials do not penetrate or impact an unplanned geological zone, especially areas of ground water. Well fracing is performed in order to stimulate the production of natural gas.</p> <ul style="list-style-type: none"> • Widely used and necessary in much of the Piceance Basin due to the very tight gas sands that contain the natural gas resource. • Most applicable in areas highly sensitive to potential ground water impacts. | RECOMMENDED |

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| Ground Water | Well Casing | <p>Well Casing design and integrity is paramount in the protection of ground water resources.</p> <ul style="list-style-type: none"> • Surface casing should be set at a depth to ensure protection and isolation of ground water resources. • Intermediate casing strings will be used if additional water zones are found to exist during drilling activities in order to isolate these zones from production zones. • Bradenhead gas monitoring of annulus in conjunction with a properly engineered casing ensures the mechanical integrity of the well and the isolation of production from other subsurface resources. | RECOMMENDED |
| Ground Water | Cement Bond Logs | <p>Cement Bond Logs are a written record to validate the integrity of well cement jobs to protect subsurface resources from production or well completion impacts (muds, fluids, gases, etc.).</p> <ul style="list-style-type: none"> • A proper cement job in conjunction with a properly engineered well casing can essentially eliminate the probability of commingling of resource zones (gas, water, etc.). | RECOMMENDED |

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| Surface Water, Ground Water | Lined Reserve Pit | <p>Lined Reserve Pits are synthetically lined reserve pits for drilling and production fluids, used to minimize potential unforeseen impacts to surface or ground water resources.</p> <ul style="list-style-type: none"> An additional level of protection compared to common unlined earthen reserve pits. | MANDATORY minimum standard |
| Surface Water, Ground Water | Closed Loop Drilling | <p>Closed Loop Drilling eliminates the need for a reserve pit for circulation water and drilling mud.</p> <ul style="list-style-type: none"> Most applicable in areas highly sensitive to potential ground water impacts | RECOMMENDED |
| Noise | Insulated Enclosures | <p>Insulated Buildings or Enclosures muffle noise from compression or processing facilities.</p> <ul style="list-style-type: none"> Required if a facility that generates noise cannot meet Colorado Oil and Gas Conservation Commission noise level standards. Also provides added protection from the elements and can increase equipment service life. | RECOMMENDED |
| Noise | Hospital Grade Mufflers | <p>Hospital-Grade Mufflers or equivalent are encouraged to minimize noise impacts to neighboring landowners.</p> <ul style="list-style-type: none"> Colorado Oil and Gas Conservation Commission applicable noise standards will be strictly enforced. | RECOMMENDED |

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| Odor | Combustion Units | <p>Combustion Units are used at production facilities to minimize volatile emissions from locations but also work well at controlling potential odor impacts to nearby surface occupants.</p> <ul style="list-style-type: none"> Any well location with on-site production units and liquids storage within 1,000 feet of an occupied surface facility should employ this type of device to prevent potential odor-related impacts. | MANDATORY minimum standard |
| Ground Water, Surface Water | Secondary Containment | <p>Secondary Containment systems are engineered systems with synthetic liners, used to minimize potential impacts to surface or ground water from possible spill or releases of materials at drilling and operations sites.</p> <ul style="list-style-type: none"> This is a standard operating procedure associated with energy development and production activities. Type of secondary containment is optional, e.g. properly installed Sioux Steel Containment units or equivalent. | RECOMMENDED |
| Ground Water, Surface Water | Loadout Containment | <p>Loadout Containment involves capturing residual material that may be left in the loadout lines or hoses used for transferring liquids from storage tanks to a water or condensate truck for site removal.</p> <ul style="list-style-type: none"> Production, compression and processing facilities generally contain storage tanks for production water and condensate. Minimizes potential cumulative impacts associated with multiple spill events. | MANDATORY minimum standard |

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| Ground Water, Surface Water | Baseline Water Quality Surveys | <p>Baseline Water Quality Surveys quantify water quality conditions prior to development activities.</p> <ul style="list-style-type: none"> • Water quality surveys serve all parties beneficially to quantify water quality conditions prior to, during and following development activities. | MANDATORY minimum standard |
| Visual, Wildlife, Surface Water | Reclamation | <p>Reclamation using native, weed-free seed mixes should be employed with all surface-disturbing activities to prevent the spread of undesirable or noxious plant species and to minimize visual, wildlife, and stormwater impacts caused from any kind of surface-disturbing activity.</p> | MANDATORY minimum standard |
| Geotechnical Hazard Constraints (Steep slopes, mud slides, unstable slopes/soils, faults, earthquake epicenters, etc.) | Relocation of Development Site | <p>Relocation of Development Site is often necessary to avoid geohazard areas.</p> | REQUIRES ON-SITE INSPECTION TO DETERMINE APPROPRIATE LOCATION |
| Wildfire Hazards | Consultation with State Forest Service | <p>Consultation with the Colorado State Forest Service on techniques to minimize the potential for facilities to be ignited by wild fire and for development activities and facilities to ignite surrounding vegetation.</p> <ul style="list-style-type: none"> • Creation of defensible space around development sites and facilities is minimum treatment in most cases. • Applies to all lands rated as being medium or higher wildfire hazard areas. | MANDATORY minimum standard |

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| Wildlife | Consultation with DOW | Consultation with the Colorado Division of Wildlife and/or the US Fish and Wildlife Service is required by the Colorado Oil and Gas Conservation Commission's rules and regulations. | MANDATORY minimum standard |