4.0 Environmental Effects

4.1 Introduction

This chapter presents the analysis of impacts for each resource that would be affected by the proposed project. Each section provides an overview of the issues identified during public scoping as well as during discussions with BLM staff and interviews with industry and local community representatives. Each section summarizes the method of analysis including the type of information used and the assumptions made during the impact analysis, then describes the projected analysis of impacts for each alternative in as much detail as possible. Resources were evaluated according to the available data, so some discussions are based on qualitative information and some on more detailed quantitative data that was prepared for the project or acquired from other sources.

Impact analysis assumes that the applicant-committed environmental protection measures and those required by the BLM would be successfully implemented. It is also assumed that the proponent, Intrepid Potash, would comply with state and federal regulations that are applicable to the project. Each section identifies key points on which the determination of the significance of impacts is based, recommends mitigation measures where appropriate to minimize potentially significant or important impacts, then provides a brief comparison of impacts under each alternative. Residual impacts are those that would remain after environmental protection measures, recommended mitigation measures, and compliance with laws and regulations are completed if impacts cannot be fully avoided or mitigated.

No impacts from the proposed solution mining project have been identified that would affect operations or land at WIPP, so it will not be discussed further in this chapter.

4.2 Geology and Minerals

4.2.1 Issues

4.2.1.1 Subsidence-related Hazards

Subsidence issues are prevalent in southeastern New Mexico. Subsidence can result from natural conditions found in the Delaware Basin or mineral extraction activities and potentially can affect surface resources, structures, and utilities associated with the project. Removal of subsurface material creates underground voids. Voids may cause subsidence and associated effects. Another major concern is the presence of plugged and currently operating oil and gas wellbores that penetrate the proposed potash solution mining zone. Wells that have poor casing and cement integrity are potential conduits for unsaturated fluids. Through wellbores, unsaturated fluid can reach potash mining flood pools on the surface and potash mining solutions can reach oil and gas producing zones below. Unrestricted migration of unsaturated fluids can also cause dissolution of evaporate zones and create voids.

4.2.1.2 Other Geological Hazards

Potential hazards from seismicity are of lesser concern due to the low probability of adverse effects to the project. Landslides are not considered further because of low potential for these hazards to impact the project.

The primary concerns from project implementation related to the impacts on caves and karst features include the following:

- Dewatering of the near-surface karst aquifers may cause a loss of habitat for cave-adapted species.
- New surface facilities may leak or rupture due to ground shifting caused by the collapse of karst features.
- Brine water from leaking or ruptured pipelines may enter the groundwater system through surface karst features.

4.2.1.3 Mineral Resources

There are several issues related to mineral resources that were raised primarily by the oil and gas industry related to the historical conflicts between mining and oil and natural gas production. Addressed in this section are concerns that the proposed project may result in:

- Restricted access to oil and gas resources.
- Damage to existing oil and gas wells and surface facilities resulting in lost or delayed recovery of the resource.
- Increased fluid mineral recovery costs due to drilling and well construction problems such as lost circulation or highly corrosive fluids.

4.2.1.4 Paleontological Resources

Impacts to paleontological resources potentially could occur from the loss and destruction of scientifically important fossils.

4.2.2 Method of Analysis

4.2.2.1 Geological Hazards

Subsidence

In the analysis of impacts of subsidence, the following information was reviewed to determine the effect that natural and human-caused subsidence would have on the proposed facilities and land in the project area. The analysis and findings detailed in the technical support document "Regional Geology; Geology and Minerals Issues Related to the Proposed HB In-Situ Solution Mine Project" (AECOM 2010a) are incorporated by reference.

- Publicly available reports on local evaporite karst conditions including, but not limited to Bachman (1985); Hill (1996); Lambert (1983); Powers and Owsley (2003b); and Vine (1963, 1960).
- Documentation on sinkholes in the vicinity of the project area.
- Publicly available information on the effects of subsidence on surface infrastructure (Galloway 2008; Johnson 2005).
- Reported and predicted subsidence from historical potash mining (Golder and Associates 1979).
- Predictions of expected subsidence from solution potash mining (Intrepid Potash, Inc./Shaw 2008a,b,c).
- Basic principles of subsidence resulting from the mining of tabular ore bodies (British National Coal Board 1975).
- Thickness and depth of the previously mined ore zone that is the target of proposed solution mining.

Oil and Gas Activities

The analysis of potential impacts on the proposed project from oil and gas activities was determined based on information available regarding well drilling and completion practices in the proposed flood zones. The information available includes:

- The OCD database (OCD 2009a) provided well drilling histories, completion reports, sundry notices, plugging reports, relevant correspondence, and environmental files.
- Academic journals that document the historic drilling and completion practices in the project area (Cearly 2000; Johnson et al. 2003a; Powers 2003a,b; Wills 1942).

The data and information sources were reviewed for information on well completions, cementing, operational integrity, produced water disposal, and plugging integrity. This information was analyzed to assess the potential risk that the well bores may act as migration pathways for fluids.

Other Geological Hazards

The following types of information were reviewed to determine the nature and potential severity of seismicity in the project area and southeastern New Mexico.

- Quaternary Fold and Fault Database (USGS and NMBGMR 2006).
- National Earthquake Information Center (USGS 2010).
- USGS National Seismic Hazard maps (Peterson et al. 2008).
- National Atlas (2009).

4.2.2.2 Caves

The following types of information were reviewed to gain an understanding of cave formation and potential hazards posed by caves as well the risks to caves from proposed project activities:

- BLM documentation of the location of caves and their value.
- Discussion with BLM personnel knowledgeable of caves in the area.
- Published literature on caves and karst in the Delaware Basin including Hill (1996, 1987); Lambert (1983); Southwest Region National Speleological Society (1991); Stafford (2008); Vine (1963).

4.2.2.3 Mineral Resources

The following documents and sources were reviewed pursuant to impact analysis to mineral resources:

- Information available online in the OCD database (OCD 2009a).
- Publicly available publications concerning history of oil and gas development and resource assessment in the Delaware Basin in general and the SPA in particular including Broadhead et al. (2004); Montgomery (1965); Schenk et al. (2008); and Walsh (2006).
- Publicly available information on potash mining in the Delaware Basin including mining history, mining methods, production, and remaining reserves including Barker et al. (2008); Cheeseman (1978); Kern (1984); USGS (2009a).
- Government agency documents including the Secretary's Potash Order (1986 Order) and Order R-111-P (OCC 1988).
- IM NM-2011-03: Interim Processing Guidelines, Oil and Gas applications for permit to drill (APDs) within the Secretary's Designated Potash Area, Carlsbad Field Office.

- Mine Operations and Closure Plan HB In-situ Project (Intrepid Potash, Inc./Shaw 2008a).
- BLM estimates of future oil and gas drilling in the SPA (Alderman 2010).

The information and data described above was reviewed to determine what impact the proposed project activities would have on the recovery of additional potash resources and impacts to the accessibility to oil and gas resources.

4.2.2.4 Paleontological Resources

The following sources of information were reviewed in the analysis of potential impacts to paleontological resources:

- BLM statutes and guidance regarding regulation of fossil resources on public lands (2010, 2007a).
- Published information sources on paleontological resources in the project area and the Delaware Basin including, but not limited to, Harris (1993); Hill (1987); King (1948); Lehman and Chatterjee (2005); Vine (1963); Walter (1953).

The PFYC of each formation was used to develop an assessment of risk to potential fossil resources with regard to ground-disturbing activities from the proposed project.

4.2.3 Assumptions

Assumptions used in the analysis of subsidence impacts:

- The natural process of evaporite dissolution is ongoing and will continue for the foreseeable future.
- Naturally induced subsidence may pose risks equal to anthropogenic-induced subsidence and the potential for the manifestation of subsidence may not be predictable.
- The potash mining industry in the region has experience with the extraction of tabular ore bodies that result in predictable subsidence effects based on well-established parameters.
- There are no major faults or discontinuities in the project area that would cause the typical subsidence patterns to be altered.
- Adverse impacts from natural subsidence would occur if the hazard presents an imminent risk to public safety.
- Direct effects include subsidence that damages roads, utilities, and structures. Impacts from direct effects range from very slight (extension cracks) to severe (sinkholes).
- Indirect effects include the alteration of surface drainage, disruption of shallow water tables, and public safety hazards.

Assumptions used in the analysis of potential impacts from oil and gas activities:

- Information available in the OCD online database is substantially complete.
- Oil and gas wells drilled and operated prior to 1955 and within mined out areas (not just the proposed flood zones) are the main focus of this analysis.
- Wells plugged under the supervision of the potash mining company may not have guaranteed the safety and integrity of the plugging.
- Improper plugging could result in catastrophic subsidence similar to the Wink and Jal sinkholes (described in Section 3.2).

Assumptions used in the analysis of potential impacts to caves and karst include the following:

- Underground voids (karst features) derived from natural processes may be present, but have yet to be manifested on the surface, posing hazards to activities and facilities on the surface through collapse.
- Some caves in the area have been nominated as Significant Caves under the Federal Cave Resources Protection Act of 1988 based on several resource values. It is assumed that there are other caves yet to be discovered that have the potential to be nominated and listed.
- Impacts to cave resources would be considered significant if caves were disturbed to the point where there is a loss of unique cave resources or values.

Assumptions used for other geological hazards

- Based on the lack of seismic activity and the absence of active faults in the project area, the risk of impacts due to ground motion and permanent ground deformation are expected to be very low under all alternatives and will not be discussed further in this analysis.

Assumptions used in the analysis of potential impacts to mineral resources include the following:

- Existing mineral resource recovery estimates are reasonable.
- Conditions of approval and requirements set forth by the 1986 Order and Order R-111-P would be substantially unchanged over the lifetime of the proposed project.
- Impacts to mineral resources would be considered significant if there were a permanent or irretrievable loss of the ability to access and recover a commercial mineral resource.

Assumptions used in the analysis of impacts to paleontological resources include:

- The fossil potential designations for the various formations were based on criteria presented in the PFYC and available data.
- Impacts would be considered significant if proposed activities resulted in the loss of scientifically important fossils.
- Direct impacts would include the destruction or degradation of fossils.
- Indirect impacts involve the restriction of permitted paleontologists access to potential localities unless a discovery is made due to ground-disturbing activities.

4.2.4 No Action Alternative

If the proposed project is not implemented, a number of potential impacts would still present risks to resources in the project area. Those potential risks and impacts are discussed below.

4.2.4.1 Geologic Hazards

Subsidence would continue to pose risks to surface resources. The natural processes that resulted in evaporite karst features in the area would continue to pose risks to roads, structures, and surface topography. The residual subsidence effects of historical mining may continue indefinitely. Because most subsidence from historical mining has probably already occurred (Golder and Associates 1979; Intrepid Potash, Inc./Shaw 2008a,b,c), the effects are expected to be minor. Oil and gas development would continue but the potential adverse impacts from poor well casing integrity and inadequately plugged and abandoned wells would not affect active potash mining.

4.2.4.2 Caves

Caves and cave resources would not be affected under the No Action Alternative. However, caves may be subject to potential degradation by entry of unpermitted cave explorers. Degradation of caves and cave resources by unauthorized exploration are expected to be minor with BLM maintenance of cave lists and locations not accessible to the general public. Under the No Action Alternative, fluid mineral and mining activities would continue to be regulated by the BLM measures designed to lessen impacts to caves and cave resources.

4.2.4.3 Mineral Resources

Under the No Action Alternative, the following impacts would be expected:

- The remaining potash resource in the proposed solution mining areas would not be recovered, resulting in the loss of the resource and loss of revenues, taxes, and royalties. The impact would be significant because the loss of the resource would be irretrievable unless another practical method could be found to extract the resource safely.
- Intrepid's total acreage of federal potash leases would not be allowed to exceed the current 96,000-acre maximum in New Mexico, per 43 CFR §3503.37, as amended.

4.2.4.4 Paleontological Resources

Impacts to paleontological resources under the No Action Alternative may occur due to the potential unauthorized collection of fossils. Due to the low PYFC of the geologic formations and few documented paleontological resources, the potential for adverse impacts to paleontological resources is low.

4.2.5 Alternative A—Proposed Action

4.2.5.1 Geological Hazards

Subsidence

Evaporite karst is an ongoing and documented process in the areas where the Rustler Formation outcrops or is very close to the surface in the Nash Draw and vicinity including the project area (Powers and Owsley 2003b). Karst features include caves, sinkholes, dolines (broad depressions), collapse valleys (swales). Direct effects from subsidence can include pushed up well casings, damaged or failed well casings, cracking and fissuring of the ground, damaged or broken pipelines or other buried utilities (Gallaway et al. 2008). Sudden collapse without obvious warning may occur, or migration of a void to the surface is often accompanied by gentle ground deformation prior to collapse. Indirect effects are often alteration of surface drainage commonly resulting in impoundment of runoff or "sinking streams," disruption of shallow water tables, livestock or wildlife loss, and public safety hazard. Components of the Proposed Action most at risk are facilities such as wells (injection, extraction, and supply); water pipelines; lined ponds; and roads.

There are important differences between natural subsidence and subsidence caused by mining. Mining subsidence can be more predictable than natural subsidence. The following paragraphs describe in detail how mining subsidence has and would most likely occur in the future for both traditional mining methods and solution mining.

The surface effects from the collapse of room-and-pillar workings depend on the depth and geometry of the workings, as well as the strength and integrity of the pillars and the surrounding and overlying strata. The amount of subsidence realized at the surface is dependent on the depth, width, and thickness of the minerals extracted, the ratio of the extracted void (mined out area) to the retained pillar area, and the extent of area over which underground pillar failure takes place.

The maximum depth of subsidence that could occur cannot exceed the thickness of the zone of mineral extracted (i.e., the mining thickness) (Van Sambeek 2008). Maximum subsidence depth is seldom observed, due to one or more of the following reasons:

- Subsidence spreads over an area somewhat larger than the mined area, so the depth of subsidence is proportionately less than the total mined area.
- Convergence, or closure of the mined area, is never fully complete or total. Therefore, some voids remain, reducing the amount of subsidence.
- The overlying strata (i.e., overlying rocks) expand slightly in volume due to breakage as the ground moves downward into the mined area, resulting in a "bulking" effect, which contributes to a reduction in total subsidence volume and depth.
- The subsidence process can be slow for rocks that creep—several hundred (or more) years may be required for complete subsidence to occur.

It is important to note that both historic data and anecdotal evidence suggest that for the southeastern New Mexico potash mines, virtual completion of the maximum surface subsidence profile occurs within just a few years (5 to 7 years) after completion of second mining (Intrepid Potash Inc./Shaw 2008b). Because potash and other salts are classified as an elastoplastic rock, minor, protracted subsidence or creep may continue to occur over an extended period of time. Elastoplastic rocks are massive, homogeneous, and relatively elastic, possessing load-deformation characteristics that deviate significantly from a straight line.

Historic data and observations of subsidence effects in the potash areas of southeast New Mexico have demonstrated that the relationship between the extent of vertical surface subsidence and the thickness of the mining horizon varies with the degree of extraction. For full extraction (100 percent) of the mineable zone, it is considered likely that the maximum surface subsidence will approach the thickness of the mined zone. This is due to evidence suggesting that there is very little breakup and bulking occurring in the overlying strata, which tends to limit the degree of subsidence. There is direct evidence of this phenomena from mining activity that was conducted in supposed "caved" hanging walls about 50 to 100 feet above the earlier mined horizons. In those caved hanging wall applications, the ore beds suffered no noticeable structural deformation other than the elevation differential induced by subsidence (Golder and Associates 1979).

Within the Salado Formation, the First Ore Zone is present at a horizon approximately 500 feet below the top of the formation. Due to variations in thickness of the overlying formations and the dip of the beds, the First Ore Zone can occur from about 675 feet to 1,450 feet below ground surface. Most areas of the target HB potash mines were extracted in a zone 6.5 feet thick or less, with an average mining thickness of about 5 feet (Intrepid Potash, Inc./Shaw 2008b; RESPEC 2011). For this reason, surface subsidence over the HB Mine area proposed for in-situ solution mining would not be expected to be as great as that for surrounding mines with thicker ore extraction heights. Information to further support this conclusion can be found in the technical support document, titled "Regional Geology; Geology and Minerals Issues Related to the Proposed HB In-Situ Solution Mine Project" (AECOM 2010b).

According to Intrepid Potash records, during the period when PCA operated the targeted HB mine workings, approximately 63 percent of the ore reserve was extracted during what was referred to as "first mining" (Intrepid Potash, Inc./Shaw 2008b). Removal of that percentage of the ore reserve typically results in a corresponding decrease in the available cross-sectional area remaining to support the overlying rock and an increase in the magnitude of vertical stress on the ore in the remaining pillars. The increase in vertical stress is offset by the plastic nature of the salt (i.e., the salt adjusts for the change in stress through very slow, flow-like movements) and through redistribution of the stresses to the edges (the surrounding intact rock) of the mine workings. This pressure redistribution is referred to as "arch action."

Once “first mining” was completed, retreat or “second mining” was carried out by removing certain portions of the pillars and barriers in order to increase overall ore recovery. This second mining was typically accomplished by taking cuts through the center of the pillars, generally 90 degrees offset from each other to preserve four corners of each pillar for support. The pillar remnants may be insufficient to support the overlying ground because the stress must be carried over a reduced cross-sectional area. The increase in localized stress is sufficient to cause failure of the pillar remnants.

Pillar failure occurs shortly after second mining is completed, typically within about one month after second mining (Intrepid Potash, Inc./Shaw 2008b). Shortly after the secondary removal cuts are made within the pillar, the residual corner pillars typically begin to compress or crush due to the increased vertical stress from the overlying rock. The pillars generally slough or spall off at the midriff of the pillar so the pillar ultimately assumes an hour-glass shape. The sloughing and spalling action causes debris to accumulate on the floor surrounding the pillar. In the advanced stages of compressive action (as closure or full convergence of the mining void is approached), the roof may receive some support from the debris pile or underground backfilling from non-economic material within mined-out areas, ultimately delaying or precluding full convergence in a localized area of the mine.

During the second mining of the target inactive workings, the company extracted a nominal 20 percent of the remaining ore in place (of the 37 percent that remained as pillars or barriers) (Intrepid Potash/Shaw 2008a). As a result, the total extraction rate (percent calculated as = 0.63 + [0.20 x 0.37]) reached approximately 70.4 percent of the ore reserve in the mines.

Second mining was employed extensively throughout the HB Eddy Mine in order to increase ore recovery. While subsidence was generally observed to begin within one month following completion of second mining, various studies indicate that small settlements of 1 to 2 inches continued to occur several years thereafter.

Several subsidence studies were conducted in the late 1950s by United States Potash (Intrepid Potash, Inc./Shaw 2008c). Findings from these studies suggest that first mining ore removal had the potential to influence the surface at about 20 percent of the mined height, with second mining contributing an additional 50 percent of the mined height. Thus, the total surface expression of subsidence over a 6-foot-thick nominal mining zone would approximate 4.2 feet (calculated as [0.2 x 6 feet] + [0.5 x 6 feet]).

Predicted Subsidence Effects Associated With Proposed Solution Mining

In its most general form, solution mining is the process of extracting soluble minerals such as potash by:

- Introducing a reactionary fluid into the subsurface.
- Dissolving the mineral or rock and forming a brine.
- Recovering the brine.
- Extracting the mineral from the brine (usually by evaporation).

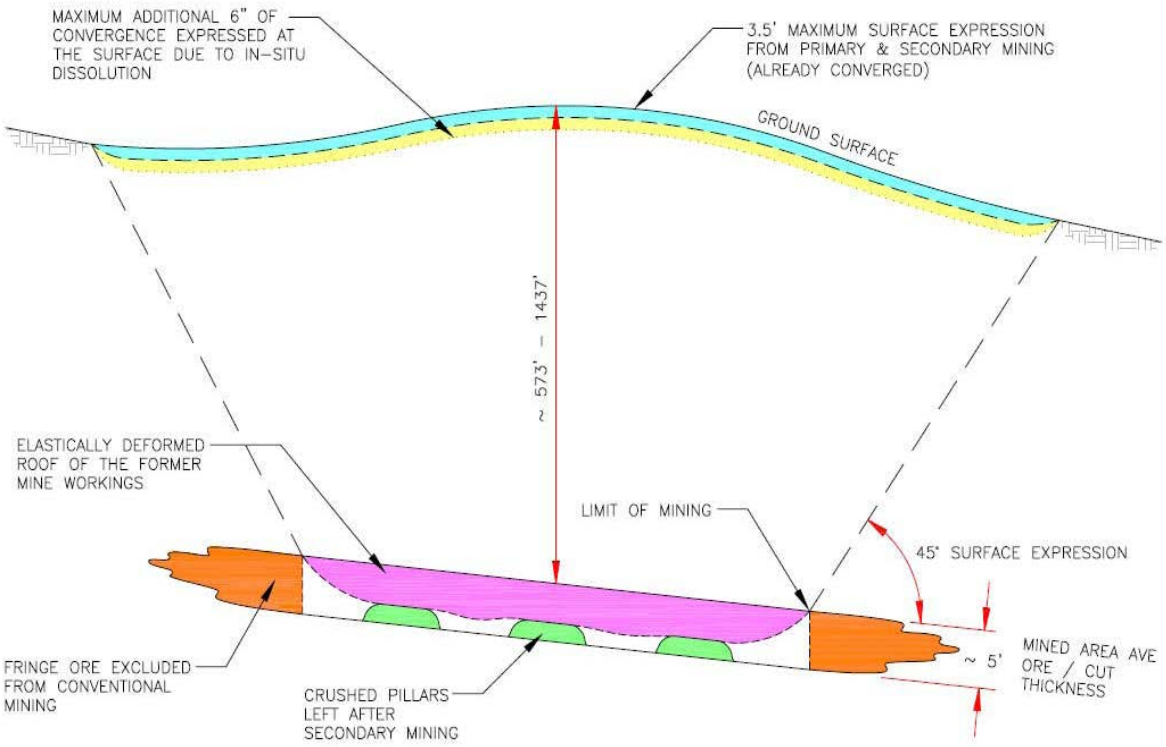
Solution mining typically involves creating underground cavities that are filled with a brine solution, which may be located in bedded salts, salt domes, or salt anticlines. The proposed project exhibits a maximum mined thickness ranging between 5 and 7 feet in the First Ore Zone, which physically limits the size of the solution cavity.

Solution mining of potash ore has been performed at the former Texas Gulf mine (now owned and operated by Intrepid) in Moab, Utah. The solution mining in Moab occurred after the conversion from conventional room-and-pillar underground mining techniques. Solution mining at this location was successful in particular because of the large surface area of potash ore presented by the original room-and-pillar workings of the mine. Since initiation of solution mining, the potassium oxide content of the brine pumped to the surface has continuously diminished with leaching of the mine pillars; however,

there has been little indication of active dissolution occurring in ore beyond the original workings (Williams-Stroud et al. 1994).

There are very little data or documentation available to allow analysis of the effects of solution mining on previously mined areas or the associated incremental subsidence. However, it is understood that solution mining would further remove potash ore and correspondingly, result in incremental subsidence effects based on information available regarding subsidence effects induced by room-and-pillar mining. The in-situ solution mining process would result in solubilization of ore from exposed remnant pillars and debris piles, with a lesser contribution expected from wall and floor rock. Wall and floor rock define the transition or contact zone between the ore and surrounding host rock. There would be some control in the in situ process because the injectate would be conditioned to selectively dissolve KCl through an ion exchange process. It is anticipated that a replacement lattice of NaCl would remain within the residual contact zone. Thus, the volume of NaCl precipitated correspondingly "reduces the potential for convergence and surface subsidence volume" (Van Sambeek 2008). Therefore, the remaining support of non-collapsed residual pillars or debris piles is not expected to dissolve to completion. The structural features would likely still function to partially support the overlying rock materials.

Because some subsidence has already occurred, the in-situ process may cause subsidence seen at the surface by an additional 10 percent of the overall mined height (Intrepid Potash, Inc./Shaw 2008a). For the average 6-foot mining height, this would represent a nominal 0.6 feet of additional subsidence at the surface (see **Figure 4.2-1**). The predicted overall maximum surface subsidence expression is about 4.8 feet. **Figure 4.2-2** shows the extent of the area where subsidence is likely to occur as a result of implementing the Proposed Action.



Source: Intrepid Potash, Inc./Shaw 2008a

Figure 4.2-1 Representative Subsidence Cross-section

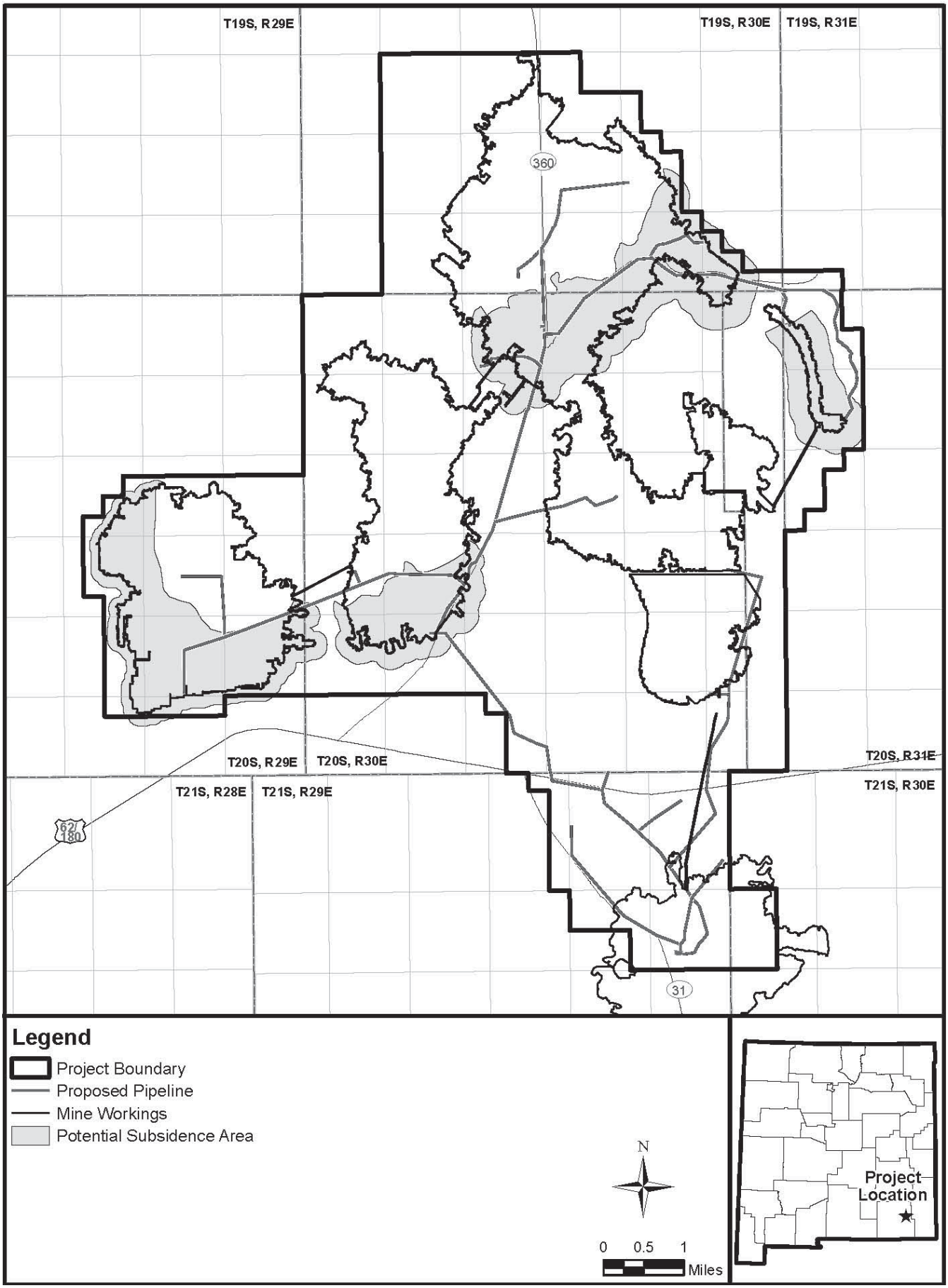


Figure 4.2-2. Potential Subsidence Areas

Due to the widespread areal distribution of the proposed in-situ process throughout the project area, this additional 0.6 feet of subsidence would likely manifest itself very gradually over a few years. It is highly probable that such gradual deformation would result in the development of wide-area, gentle depressions rather than localized, abrupt changes in the ground surface.

The solution mining proposed by Intrepid would not be conducted in the same manner as the brine extraction operations in the region. This is due to the use of brine injectate and the development of a replacement lattice of NaCl that would stabilize the remaining rock, as described above. Therefore, the proposed solution mining would not result in the catastrophic collapse and the creation of large, deep sinkholes that occurred following brine mining, as described in Section 3.2.3.1.

Hazards Related to Oil and Gas Activities

Oil and gas activities raise concerns for the proposed project due to the questionable integrity of some of the casings in the older oil wells and the inadequate abandonment procedures of wells located in and near the proposed flood zones. The HB South inactive workings that would be flooded under the Proposed Action are located above the producing formations of the Barber Oil Field. Active and abandoned oil wells and a salt water disposal well extend through the inactive mine workings targeted for solution mining (see **Figure 3.2-7**). There are no active wells located within the proposed flood zone. The salt water disposal well operated for many years to dispose of produced water in a shallow zone in the Rustler Formation, which, based on logs of nearby oil wells, may have included the Magenta Dolomite. Most Barber Field wells, active or abandoned, are located within a shallow closed depression. Another critical area of concern is the Getty Oil Field at the HB Eddy Mine. Although the Getty Field is now abandoned and is not located within the proposed flood zone, the integrity of the wells are still a concern to nearby potash mines and groundwater quality because records indicate that not all of the wells were adequately plugged (OCD 2009a).

The existence of a salt water disposal (SWD) well at Barber Field that was used to dispose of an estimated 100,000,000 or more barrels of unsaturated produced water into a shallow zone in the Rustler Formation poses serious concerns. Those concerns are as follows:

- There are no data regarding where the water went, the potential extent of solution of evaporite layers, and whether a void has been created in the subsurface underneath the oil field.
- Evidence of the impoundment of surface water runoff in the vicinity of the oil field may indicate that subsidence has occurred or is ongoing, but the cause of the backup of runoff is not known. The USGS topographic map of the area clearly shows a closed basin that essentially coincides with the Barber Oil field. If the cause of this depression is subsidence, it could either be the result of mining or the dissolution of evaporite beds. Impoundment of surface water runoff is often a warning or precursor to the development of a sinkhole (Dunrud and Nevins 1981).
- It is not unreasonable to assume that the disposed oil field water could have reached the targeted potash ore zones through a conduit such as an improperly plugged well or solution cavities created by uncontrolled disposed water. This could adversely affect the quality of the brine in the proposed flood pools.

The implications of the observations listed above for the proposed solution mining of potash are listed as follows:

- It has been asserted that if the integrity of the abandoned wells is compromised, upward flow from the oil-producing Yates Formation would prevent in-situ brine mining water from flowing into an abandoned well bore (Schowengerdt 2009). Given the 70 or more years of oil production, there is likely no hydraulic head in the old wells to prevent fluids from migrating down an abandoned well casing from a potash flood zone. Fluids can enter the well either through an improperly plugged well, or through active wells that are in communication with the salt section.

If the integrity of the well casing or cement has been compromised, unsaturated fluids can flow outside of the wellbore and cause dissolution of evaporate zones and create voids.

- All wells in or near the flood zone should be cause for concern as a source of unintentional brine contamination, not just the wells in the flood zone. A "good plug" might not be of much value if during the well's operational life, communication to the salt section was accomplished through lack of maintenance and casing corrosion.
- In abandoned wells where drilling mud was left in place and cement plugs were either placed over short intervals or not placed at all, the mud and short plugs may not provide an adequate seal to prevent migration of fluids.
- Because of uncertainties related to operational well integrity and proper plugging, the reported 100-foot barrier pillars that were left around oil wells do not guarantee that these pillars would provide adequate protection against the migration of fluids. No information is available to evaluate the current condition of the pillars.
- A produced water disposal zone located above the salt layer may adversely affect the ability to conduct solution mining successfully. It also may reduce surface stability and surface use by oil field surface facilities and solution mining infrastructure.

Caves/Karst

There are a number of potential impacts to karst and cave resources under the Proposed Action. The primary impact to caves would result from groundwater drawdown caused by pumping water from the Rustler Formation (see Section 4.3 for a more detailed discussion of projected groundwater drawdown). Two pumping scenarios were modeled under the Proposed Action, one for a preferred calibration and one for an enhanced calibration. Under the preferred calibration scenario, it is estimated that 42 known caves may be adversely affected by project-related groundwater drawdown. These 42 caves, of the 106 known caves located where the groundwater table is currently within 90 feet of the ground surface, are located in an area where the groundwater would be drawn down below the elevation of the deepest cave (90 feet from the surface). Under the enhanced calibration scenario, 43 caves may no longer be within the 90-foot top of groundwater elevation. The uncertainty of impacts to caves from drawdown is due to the lack of detailed information on the species and depth to groundwater existing in the caves, as well as the many variables affecting the extent of drawdown, exemplified by the use of two calibration scenarios for groundwater modeling. To account for unrecorded caves and karst features that may be affected, the acreage of high and medium cave potential can be used to aid in determining the extent of potential impacts due to drawdown.

Table 4.2-1 summarizes the number of known caves and the acreage of cave potential ratings (see **Figure 3.2-8**) that are likely to be adversely affected by groundwater drawdown. If these caves currently rely primarily on the existing groundwater table to supply water that supports cave-dwelling species, then they would be adversely affected by the groundwater drawdown associated with the Proposed Action. In this situation, the effect of groundwater drawdown would be significant because it would result in a loss of unique cave resources or values. Detailed biological inventories and groundwater level monitoring in caves would be needed to evaluate the full extent of the impacts.

Table 4.2-1 Caves or Karst Features Affected by Groundwater Drawdown under Proposed Action

Features Affected by Drawdown	Preferred Calibration Groundwater Pumping Scenario	Enhanced Calibration Groundwater Pumping Scenario
Known Caves (no.)	42	43
High Cave/Karst Potential Area (ac.)	25,668	26,720
Medium Cave/Karst Potential Area (ac.)	6,168	6,651

Table 4.2-1 Caves or Karst Features Affected by Groundwater Drawdown under Proposed Action

Features Affected by Drawdown	Preferred Calibration Groundwater Pumping Scenario	Enhanced Calibration Groundwater Pumping Scenario
Low Cave/Karst Potential Area (ac.)	15,112	15,166

Note: Numbers and acreage calculated by determining the quantity of caves and cave potential ratings that would no longer be supplied by the groundwater table within 90 feet of the ground surface.

Other potential adverse impacts to caves and karst features include the following:

- New access roads in the project area would increase the opportunity for public entry and disturbance or damage to cave resources.
- Drilling into unrecorded cave/karst features may allow water from drilling fluids and mud to enter a solution cavity and contaminate groundwater or dissolve evaporite strata. This may pose risks to groundwater quality, health and safety, roads, structures, and may alter surface water runoff patterns.
- Construction and drilling operations would pose a threat to cave and karst resources by weakening the roof of an unrecorded solution cavity. If a shallow cave or karst feature were affected, this could cause a near-surface collapse of the roof and damage or injury to drilling equipment and personnel.

4.2.5.2 Mineral Resources

The Proposed Action would have the beneficial impact of recovering additional potash reserves that would probably not be recoverable with conventional mining methods. There would be no change to access to oil and gas exploration and development in the project area.

Under the Proposed Action, the maximum acreage of Intrepid's allowable potash leases in New Mexico would increase, enabling Intrepid to continue to extract potash beyond the current acreage of federal leasing limits. This would not, however, affect oil and gas development because the existing BLM leasing and management guidelines, based on the 1986 Order, OCC Order R-111-P, and IM NM-2011-003 (see **Appendix A**) would continue to be implemented.

4.2.5.3 Paleontological Resources

Paleontological resources would be at risk for direct adverse impacts (destruction or damage) from pipeline and well pad construction activities and well drilling through fossil-bearing formations.

Indirect impacts during construction may include erosion of exposed fossil beds due to slope regrading and vegetation clearing, or the unauthorized collection of scientifically important fossils by construction workers or the public. Unauthorized collection may increase due to increased public access to fossil localities from the construction of new maintained access roads.

There is a low risk of adverse impacts to fossils under the Proposed Action. Given the low PFYC rating of surficial deposits and the limited potential for the Rustler Formation to contain scientifically important fossils, especially vertebrates, impacts to paleontological resources area expected to be small.

4.2.6 Alternative B

Most of the impacts to geological resources under Alternative B would be the same as those described for Alternative A, Proposed Action. Pumping from the Caprock well fields would reduce the quantity of Rustler water to be used, so the groundwater drawdown in and near the project area would be less.

Fewer known caves and less acreage of high and medium cave potential areas may be adversely affected by Rustler well pumping under this alternative. **Table 4.2-2** summarizes the caves and karst areas that would be affected by groundwater drawdown.

Table 4.2-2 Caves or Karst Features Affected by Groundwater Drawdown under Alternative B

Features Affected by Drawdown	Preferred Calibration Groundwater Pumping Scenario	Enhanced Calibration Groundwater Pumping Scenario
Known Caves (no.)	18	38
High Cave/Karst Potential Area (ac.)	10,977	23,961
Medium Cave/Karst Potential Area (ac.)	2,949	5,832
Low Cave/Karst Potential Area (ac.)	1,537	1,921

Note: Numbers and acreage calculated by determining the quantity of caves and cave potential ratings that would no longer be supplied by the groundwater table within 90 feet of the ground surface.

No additional adverse effects to geological resources are anticipated from the use of the Caprock well fields and construction of new pipelines or replacement of existing pipelines to provide supplemental water.

4.2.7 Alternative C

The risk of impacts to geological resources under Alternative C would be the same as those described for Alternative A, Proposed Action. The pipelines in the project area would not be buried deep enough to affect the underlying bedrock, caves, or fossil-bearing formations.

4.2.8 Alternative D—Preferred Alternative

Impacts to geological resources under the Preferred Alternative would be similar to those described under Alternative B. Minor changes to the pipeline layout in the northwest portion of the project area within the HB Eddy inactive workings would reduce the potential for impacts to karst features under the Preferred Alternative. The number of caves potentially affected by groundwater withdrawal would be the same as under Alternative B. The reclassification of potash mining leases to solution mining leases would have no effect on potash recovery or other mineral extraction (oil and gas).

4.2.9 Mitigation Measures

Recommended additional mitigation measures to minimize project-related impacts are listed in the following sections.

4.2.9.1 Subsidence

Intrepid has committed to developing and implementing a subsidence monitoring plan using a monitoring network that is already in place. Readings at the established monitoring locations would begin before the groundwater pumping and brine injection into the flood pools begins in order to establish a current baseline of the ground surface elevation. The subsidence monitoring plan would identify the monitoring locations, schedule, evaluation methods, and reporting procedures. The plan would be reviewed and approved by the BLM. It is recommended that measurements occur at regular intervals (monthly or quarterly).

Intrepid would follow the requirements listed in Section 2.4.5 with more detail provided in **Appendix B**. The protection measures would be followed for the construction of wells, roads, pipelines, and utilities.

4.2.9.2 Caves/Karst

To avoid or minimize the risk of damage to cave or karst features from construction and maintenance activities, while also avoiding the potential for collapse of karst features to damage proposed pipelines, wells, and other project facilities, in addition to the requirements listed in Section 2.4.5, the following mitigation measures are proposed.

- Intrepid should submit a final layout of all facilities for site-specific review and approval by the BLM. Any facilities that cross major karst features, as defined by BLM staff during field inspection, will be moved or modified before final approval for construction is given.
- Monitoring the stability of facilities (pipelines, wells, roads) in karst terrain should be performed on a regular basis to identify and minimize the risk of damage to facilities from ongoing karst development and to protect cave resources.
- A BLM-approved groundwater monitoring plan will be developed to check groundwater fluctuations in critical karst areas. Implementation of the plan will include a biological inventory of species in three caves designated by the BLM before groundwater pumping begins, with subsequent monitoring to determine the extent of impacts on cave water from pumping. Adaptive management strategies will be planned and implemented to mitigate groundwater drawdown that would adversely affect the water supply supporting cave species.

4.2.9.3 Mineral Resources

The requirements listed in Section 2.4.5 would be adequate to protect mineral resources. No additional mitigation measures are proposed. Notwithstanding any decisions of this EIS, oil and gas operations would continue to be conducted in compliance with the 1986 Order, OCC Order R-111-P, IM NM-2011-003, and any lease stipulations described in Section 2.4.5 and detailed in **Appendix B**.

4.2.9.4 Paleontological Resources

The following protection measures are recommended for paleontological resources:

- Construction personnel should be instructed about the types of fossils that could be encountered and the steps to be taken if they uncover potentially significant fossils during construction of the project. Instruction will emphasize the non-renewable nature of paleontological resources and that collection or excavation of fossil materials from federal land without benefit of a federal permit is illegal.
- If fossils are found, the BLM is to be contacted immediately to allow the BLM to determine whether the fossils are scientifically significant and to provide a qualified paleontologist to assess and document the find.
- If fossils are collected, they will be curated at a facility approved by the BLM.

4.2.10 Summary of Impacts

There would be more known caves affected under the Proposed Action and Alternative C than under Alternative B and the Preferred Alternative. For the other resources and issues described in this section, there would be no difference between the impacts under the Proposed Action and the other action alternatives.

4.2.10.1 Subsidence

The in-situ process may result in subsidence of an additional 10 percent of the overall height of the mined ore zone (Intrepid Potash Inc./Shaw 2008a) projected to be approximately 0.6 feet of additional subsidence at the ground surface beyond what has already occurred.

Due to the widespread areal distribution of the proposed in-situ process throughout the project area, this additional 0.6 feet of subsidence would likely manifest itself very gradually over a few years. It is probable that this gradual deformation would result in the development of wide, gentle depressions rather than localized, abrupt offsets of the ground surface.

The duration of subsidence cannot be predicted due to the nature of the salt deposits to deform slowly. Subsidence is likely to occur over an extended period of time, allowing the ground surface to gradually adjust without noticeable signs of subsidence.

4.2.10.2 Oil and Gas Activities

There are a number of concerns and potential impacts regarding past and present oil and gas activities within and adjacent to the proposed flood zones. Concerns that must be addressed include the integrity of active and abandoned wells, a SWD well used for injecting water into strata above the proposed solution mining zone, and the integrity of barrier pillars in the ore zones around oil well borings. If left untouched there would be potential for contamination that may increase the likelihood of subsidence.

If well integrity concerns can be adequately addressed through due diligence, risk assessment, and proper plugging and abandonment of at-risk wells, residual impacts from oil and gas activities should present minimal or no residual impacts to potash mining.

4.2.10.3 Caves and Karst

The primary risk to caves and karst features would result from project-related pumping of the Rustler Formation, which would lower the groundwater table below the bottom of most caves in and near the project area. Risks associated with cave and karst features include an increased potential for unauthorized public entry and disturbance or damage to cave resources, drilling into cave/karst features and allowing fresh water to contaminate groundwater, dissolve evaporite strata, and result in subsidence.

Development of caves and karst features is a natural process that can be accelerated by human activities. It is expected that the risks and concerns related to karst formation would continue well beyond the life of the proposed project. Protective measures described would reduce the risk, but cannot be fully mitigated or avoided.

4.2.10.4 Mineral Resources

The proposed project would have the beneficial impact of recovering additional potash resource that would probably not be recoverable using conventional mining methods. It also would increase Intrepid's maximum allowable total acreage of federal potash leases in the state. There would be no change in access to potential oil and gas resources.

The extraction of recoverable potash resources is an irretrievable and irreversible residual impact associated with the proposed project.

4.2.10.5 Paleontological Resources

Paleontological resources would be at risk for direct adverse impacts (destruction or damage) from pipeline, well pad, road construction activities, and well drilling. Given the low PFYC rating of surficial deposits and the Rustler Formation to contain scientifically important fossils, especially vertebrates, impacts to paleontological resources are expected to be small.

The proposed protection measures may not protect all fossil resources. Unauthorized collection and inadvertent destruction of fossil resources would continue as residual impacts and require continued enforcement of federal laws and BLM policy.

4.3 Water

4.3.1 Issues

Issues related to water resources that have been identified for the proposed project include:

- Impacts to surface runoff drainage patterns caused by surface infrastructure blocking flows.
- Potential for increased erosion by surface water due to ground disturbance and trenching activities
- Possible water contamination from evaporation ponds
- Drawdown of groundwater levels through pumping for proposed mining operations
- Potential decrease in groundwater contributions to Pecos River

4.3.2 Method of Analysis

4.3.2.1 Surface Water

Surface water impacts were assessed through Geographic Information System (GIS) analysis of:

- Proposed areas of disturbance within subwatersheds.
- Areas up-gradient from project disturbance locations.
- Areas near or crossing existing drainage-ways and floodplains.

Subwatershed boundaries were defined using the WBD (NRCS 2005). Existing drainageways were defined by the NHD high resolution dataset (USGS 2009b), and floodplains were defined by the National Flood Insurance Program, Zone A 100-year floodplains (FEMA 1991).

4.3.2.2 Groundwater

Groundwater impacts were analyzed through the use of groundwater flow models to estimate the potential availability of groundwater for the proposed project and to predict drawdown to groundwater levels compared to existing water levels in the area.

The groundwater system in the project area and impacts from pumpage of the Rustler North and South wells in the project area were evaluated using the numerical model MODFLOW 2000 (Harbaugh et al. 2000) running within Groundwater Vistas model processing software, developed by Environmental Simulations, Inc. (2007).

The Caprock aquifer and pumpage of the Caprock wells was represented through utilization of the analytic element model GFLOW, version 2.1.2 (GFLOW 2007).

Both models were used to define drawdown impacts near the pumping area, and the predictive capability diminishes near the model domain boundaries. More details on the groundwater modeling can be found in the technical report, Hydrological Assessment and Groundwater Modeling Report for the HB In-Situ Solution Mine Project EIS prepared for the BLM (AECOM 2010b).

Rustler Groundwater Model

The Rustler groundwater model domain encompasses Clayton Basin, the upper half of Nash Draw, Livingston Ridge, and Quahada Ridge, extending across T19S through T22S, and R29E through R31E (R28E through R30E in the south). These features can be located on **Figure 3.3-1**. Flow through the Magenta and Culebra dolomite members constitute the aquifers in the Rustler Formation, with groundwater movement flowing from north to south. The aquifers outcrop and end at Nash Draw to the

south. Considering these conditions, the western and northeastern boundaries were modeled as no-flow boundaries, and the remaining boundaries were constant head boundaries. The total area of the model domain is approximately 429 square miles, measuring 17.6 miles from west to east and 24.4 miles from north to south. The model grid cells are a uniform 1,000 square feet each, with six layers representing the Dewey Lake Red Beds (including overlying alluvium) and the five members of the Rustler Formation (Forty-niner Member, the Magenta Dolomite, the Tamarisk Member, the Culebra Dolomite, and the Los Medaños Member) (see **Figure 3.3-2**). Project water withdrawals were incorporated into the Magenta Dolomite layer of the model.

The model was populated with two sets of aquifer property parameters from published sources and field investigations performed for Intrepid. The model was then calibrated with water levels that have been measured over time. Calibrations indicated that the model met the goals set prior to commencement of modeling. The Rustler model was run using two hydraulic conductivity values created to account for uncertainty based on variations between values from previous studies and recent pumping tests performed for the project. Therefore, two models were developed using different hydraulic conductivity values, the Rustler Preferred Model and the Rustler Enhanced Model.

Rustler Preferred Model

The Rustler Preferred Model was run with a maximum hydraulic conductivity (approximately 180 feet per day), which represents a fracture or fault zone. **Figure 4.3-1** displays the hydraulic conductivity values used in terms of Kx or feet per day.

Rustler Enhanced Model

The Enhanced Model was developed to allow for the maximum possible flow of groundwater from an integrated fracture system that covers the eastern half of the Rustler south area, plus sections in southern Clayton Basin (Rustler north area). The Rustler Enhanced Model was run with a maximum hydraulic conductivity (approximately 100 feet per day) distributed across a more extensive area of approximately 3 square miles. An even larger area with elevated hydraulic conductivity of approximately 10 feet per day surrounded this area. While the maximum hydraulic conductivity is less than under the Preferred Model, it was applied over a larger area resulting in model results that projected higher sustainable pumping quantities from the same model domain. The hydraulic conductivity values applied for this version of the model are possible if the area were located in an interconnected fracture system. **Figure 4.3-2** displays the hydraulic conductivity values in the model domain for the Enhanced Model.

Caprock Groundwater Model

The Caprock groundwater model is distinct from the Rustler model, using a single-layer, analytic element model and a separate model domain. It was created to evaluate the potential drawdown impacts of pumping from the Caprock well field in Lea County to supplement Rustler water sources under Alternative B. The Caprock model is two dimensional, with the Ogallala Formation being the single layer. Aquifer parameters used in the model were provided by NMOSE data and published literature (McAda 1984; Musharrafieh and Chudnoff 1999).

Because GFLOW, version 2.1.2 (GFLOW 2007) cannot model time-sequenced pumping from a single well, modeling of drawdown where the pumping rate changes with time requires either modeling the maximum drawdown case or use of a time-weighted average pumping rate over the life of the well. The Proposed Action model run utilized the time-weighted average over all three phases due to relatively small differences in pumping rates between the maximum drawdown results and the time-weighted average results. Alternative B used two model runs to represent both the maximum drawdown case during Phase I and the time-weighted average to show the drawdown over the life of the proposed project.

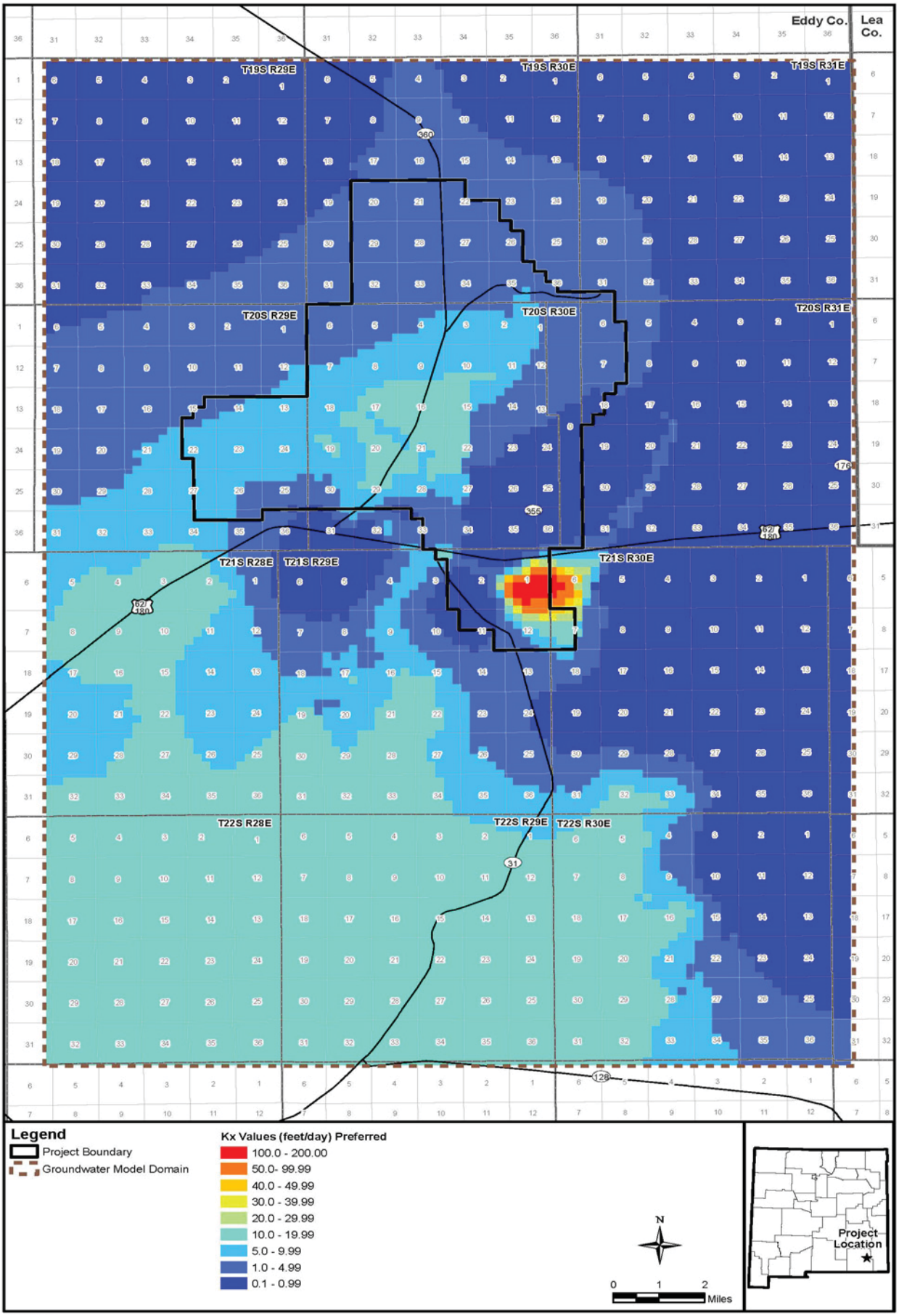


Figure 4.3-1. Hydraulic Conductivity Represented in Rustler Model, Preferred Calibration

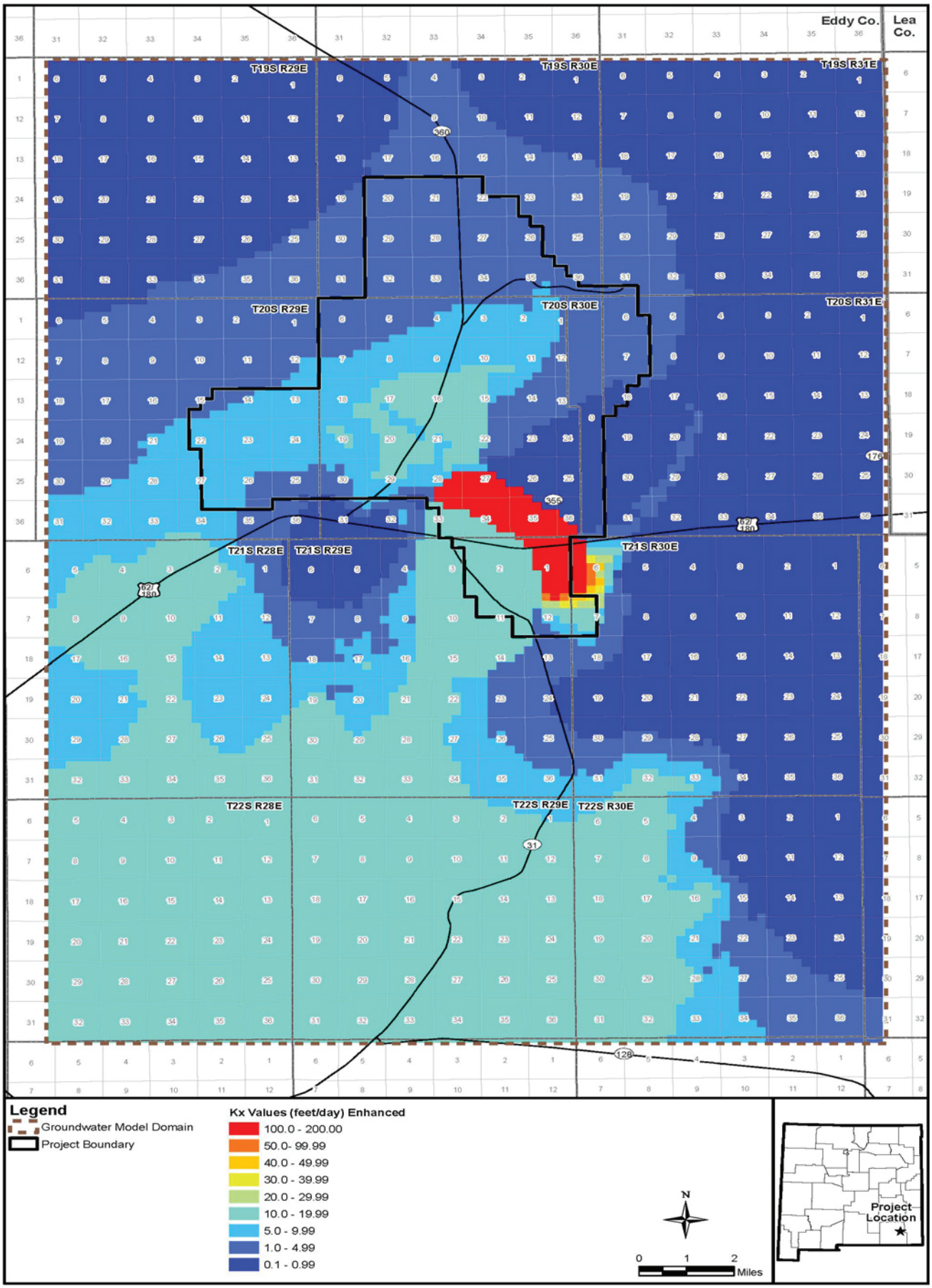


Figure 4.3-2. Hydraulic Conductivity Represented in Rustler Model, Enhanced Calibration

4.3.3 Assumptions

Impacts to water resources were determined based on the location, type of disturbance, and amount of groundwater drawdown from aquifers identified as potential sources of project water.

The following assumptions were used in the analysis of impacts to water resources:

- Hydrologic boundaries and floodplains represented in figures in Section 3.3 (WBD, NHD, FIRMs) are accurate.
- Areas of recently disturbed ground would be more susceptible to erosion.
- Erosion from disturbed areas would be minimal once vegetation or other surface stabilization is established.
- Successful establishment of herbaceous vegetation generally takes a minimum of 3 to 5 years.
- Pipelines crossing drainageways would follow the environmental protection measures for co-located roads and culverts.
- Complex groundwater systems can be adequately portrayed through the representative groundwater models.
- Groundwater level equilibrium currently exists over the model domains.
- Areas where a modeled geologic unit is absent were represented with a constant thickness of 10 feet because layers cannot be absent in MODFLOW models.
- Lead in the former PCA wells in the Rustler North area would have to be removed before it could be used in injectate brine.
- Erosion and sediment control measures and storm water protection measures would be developed and implemented as part of the NPDES Construction General Permit requirements before construction begins. A SWPPP would be developed as part of the NPDES Industrial Storm Water Permit that would apply to the new HB mill. It is assumed that these measures, in conjunction with those listed in Section 2.5.3, would be adequate to minimize adverse impacts to surface water bodies from sedimentation.

Impacts to water resources would be significant if the Proposed Action or alternatives result in one or more of the following:

- Surface infrastructure locations are within 650 feet (200 meters) of 100-year floodplain, playa, or alkali lake.
- Modeled groundwater drawdown precludes supplying the project with required water supply.
- Modeled groundwater drawdown decreases flow contributions from the project area to the Pecos River by more than 1 percent annually, compared to current average annual flow contributions (not to total flow in the Pecos River).

4.3.4 No Action Alternative

Under this alternative, no significant impacts would occur to surface water or groundwater resources in the project area. Potash mining and oil and gas activities would continue to cause small areas of surface disturbance and minor amounts of groundwater pumping are likely to continue.

4.3.5 Alternative A—Proposed Action

4.3.5.1 Surface Water

Under the Proposed Action, temporary disturbance during the construction phase of the project totals 980 acres. After reclamation of temporary disturbance and acreage recovered during the operation phase of the project, long-term disturbance would total 822 acres. Temporary and long-term disturbance within each subwatershed are listed in **Table 4.3-1**. The largest disturbance would occur from construction and operation of the evaporation ponds. Because these ponds will be engineered to contain precipitation along with the extracted mine fluid, once constructed they would not be expected to contribute to off-site erosion impacts. Similarly, the well sites will be constructed with a containment berm along the perimeter, negating any off-site erosion impacts once constructed.

Figure 4.3-3 depicts project component locations within each subwatershed. Initial disturbance in subwatersheds with Project components range from less than 0.1 percent in Scanlon Draw and Lone Tree Draw to 1.5 percent in Clayton Basin. The relatively high percentage of disturbance in Clayton Basin is largely due to the evaporation ponds being largely located here, totaling approximately 1 percent of the subwatershed's area. Considering that no offsite impacts are anticipated from the ponds, this brings the effective initial disturbance down to 0.5 percent. Similarly, in the long-term disturbance, the ponds account for 0.9 percent of the disturbance in Clayton Basin, which decreases the effective long-term disturbance of that subwatershed to 0.4 percent.

Table 4.3-1 Project-related Disturbance within Subwatersheds under the Proposed Action

Subwatershed Name	Initial Disturbance (acres)		Long-term Disturbance (acres)	
	Total	% HUC	Total	% HUC
Little Lake	46	0.2	44	0.1
Clayton Basin	833	1.6	688	1.3
Scanlon Draw	6	<0.1	3	<0.1
Lone Tree Draw	23	<0.1	17	<0.1
Maroon Cliffs	114	0.3	77	0.2
Total	1,022	0.6	829	0.5

[1] Project well site acreage is included in pipeline ROW acreage.

[2] ROW includes project pipelines, wells, roads, lift/pump stations, and power lines.

There are two separate locations where proposed pipeline and road facilities would be located within 650 feet (200 meters) of 100-year floodplains and alkali lakes (**Figure 4.3-4**). These locations are in the NE¼ Section 9 and the NE¼ Section 3, both of T20S, R30E. Both locations are identified in the NHD as intermittent waterbodies. Analysis of aerial photography indicates the waterbody in Section 9 is a dry playa and the one in Section 3 contains water for at least portions of the year.

Aboveground pipelines have the potential to block, divert, and concentrate overland storm water runoff from precipitation events. Surface pipelines may create concentrated flows or back up surface water. Where surface water is backed up behind a surface structure such as a pipeline or a road, the ponded water may overtop the structure and cause erosion on the downstream side. Where the contributing upstream drainage area is 50 acres or more, the potential for concentrated flows that might form gullies or channel headcuts is greater than in smaller upstream drainage areas (larger flows and higher water velocities increase the water's potential to move soil). Intrepid has committed to burying the pipeline every 0.25 mile, which would not allow for large drainage areas to be concentrated along long runs of pipe.

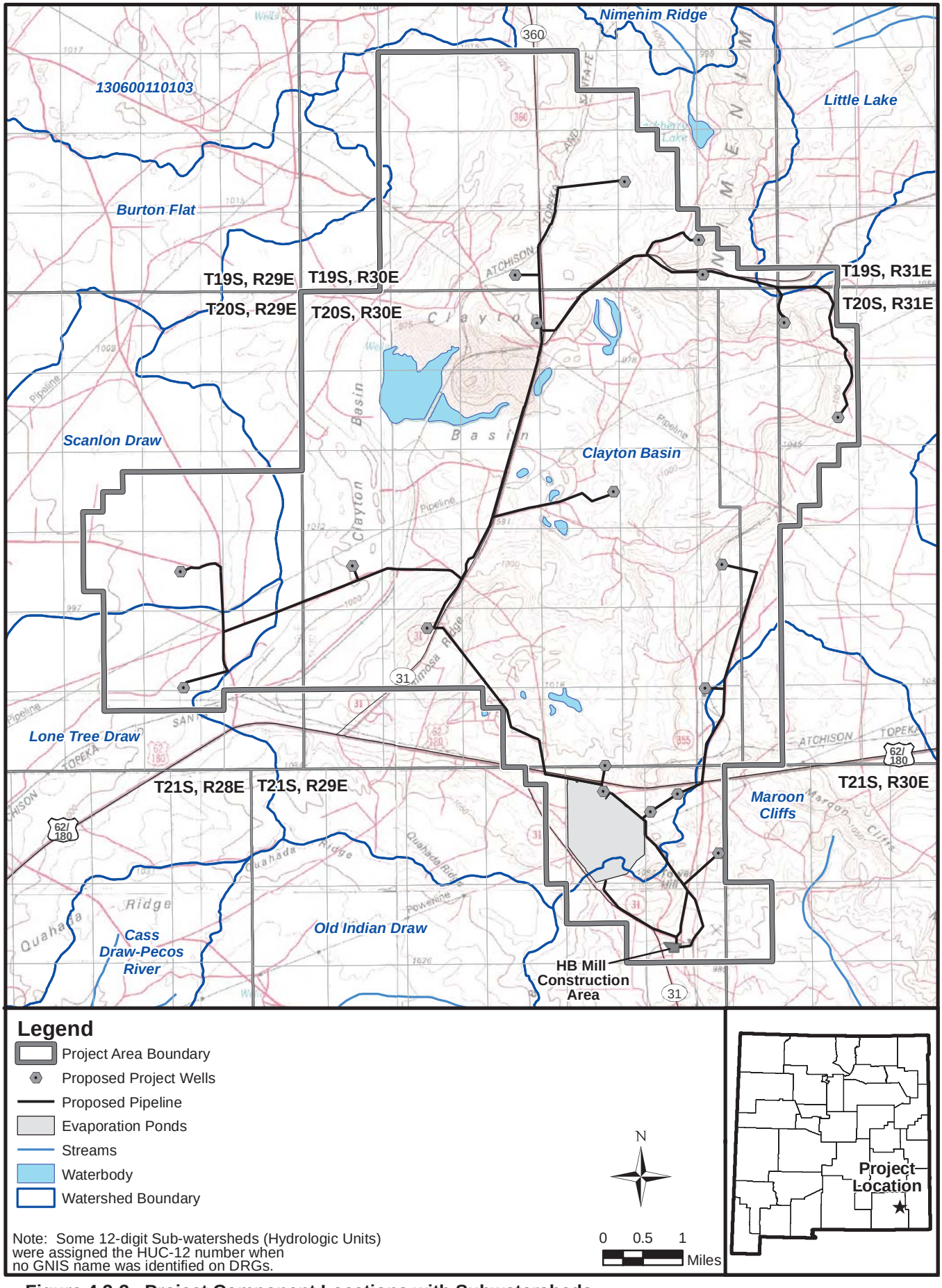


Figure 4.3-3 Project Component Locations with Subwatersheds

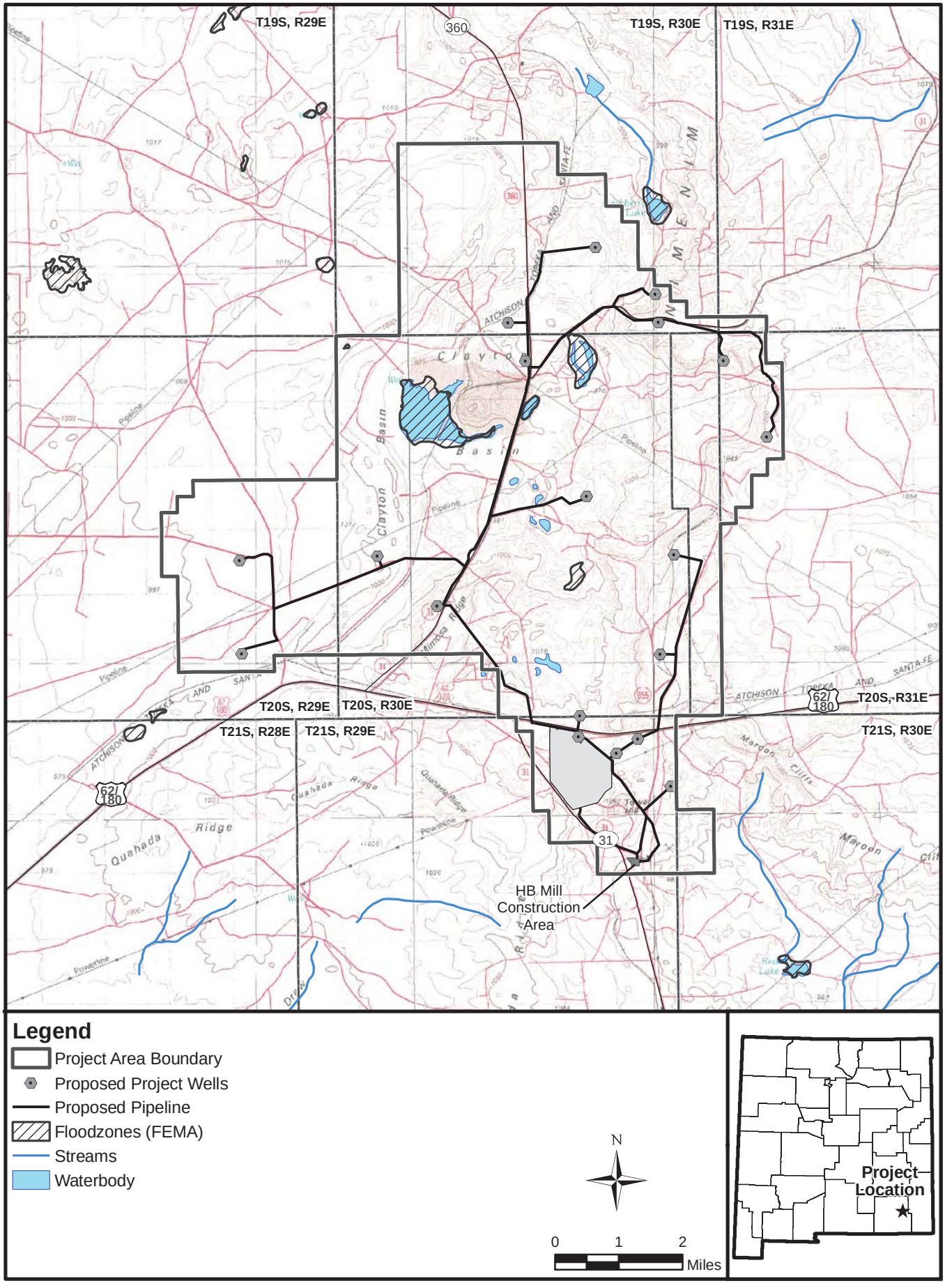


Figure 4.3-4 Project Components and FEMA 100-Year Floodplains

Proposed pipeline locations were largely co-located with existing roadways as well, where runoff concentration and its impacts would already be occurring and likely to be conveyed through culverts or dips in the road. Locations along the proposed pipelines that would not be co-located with existing roads and would traverse across slopes where pipeline sections are long (between approximately 0.2 and 0.5 mile) have been identified as areas of concern in the following locations:

- NE¼ Section 35, T19S, R30E
- SE¼ Section 15, T20S, R30E
- Section 24, T20S, R31E
- NW¼ Section 6, T21S, R30E

Multiple locations where pipeline and road facilities would cross existing surface water flow drainages (or waterways) of concern have been identified through GIS analysis (see **Figure 4.3-5**). There are nine locations, identified through analysis of the NHD, where the proposed pipelines would cross existing drainages. There are three locations where surface pipelines intersect points with large contributing drainage areas (from 50 acres to 2,500 acres upstream) that were not identified as waterways in the NHD. The nine crossings identified through the NHD have drainage areas from 10 acres to 2,500 acres.

Potential impacts to existing water resources through ruptures or spills from the pipelines or ponds (abnormal operations) during the operations phases would not be expected. In the event that abnormal operations occur, they would be minimized by automated sensing and shutdown equipment. Regular on-the-ground monitoring and inspections for detection of minor incidents would be implemented to identify leaks and ensure that equipment is running properly.

4.3.5.2 Groundwater

Groundwater impacts were analyzed under two scenarios for the Proposed Action. Pumping of the Rustler North and South areas was modeled with both the Rustler Preferred Model and the Rustler Enhanced Model. The Caprock Model was used to predict drawdown using only a time-weighted average for the life of the project in the vicinity of Intrepid's Caprock well fields under each of the above scenarios.

Rustler Preferred Model

Figure 4.3-6 depicts projected drawdown of the existing groundwater surface that was predicted by the Rustler Preferred model. The maximum sustainable pumping rate under this scenario would be 1,440 gpm from the Rustler North wells and 177 gpm from the Rustler South wells. The results indicate that maximum drawdown would occur in Clayton Basin near the Rustler North well and in the area surrounding the Rustler South wells. Both of these areas would exceed 200 feet of drawdown from the existing groundwater elevations in the area, with a larger area of drawdown surrounding the Rustler South wells due to the larger number of wells being pumped and the higher hydraulic conductivities. The total area of 200-foot drawdown is approximately 1,850 acres. Drawdown of this magnitude would adversely affect groundwater levels and other water users drawing from the Magenta Dolomite member.

The 10-foot drawdown contour extends beyond the project area approximately 6 miles to the south, 4 miles to the east, 2 miles to the north, and to the no-flow boundary in the west (the edge of the model domain). The extension of the drawdown contours to the west is an artifact of the modeling.

The Rustler Preferred model results indicate that modeled groundwater contributions to springs and seeps in the calibrated model would decrease from 3,014 gpm to 1,170 gpm, a reduction of 61 percent. Groundwater flow to Nash Draw would decrease from 306 gpm to 228 gpm, a reduction of 25 percent, which indicates that there may be reduced flows into the Pecos River.

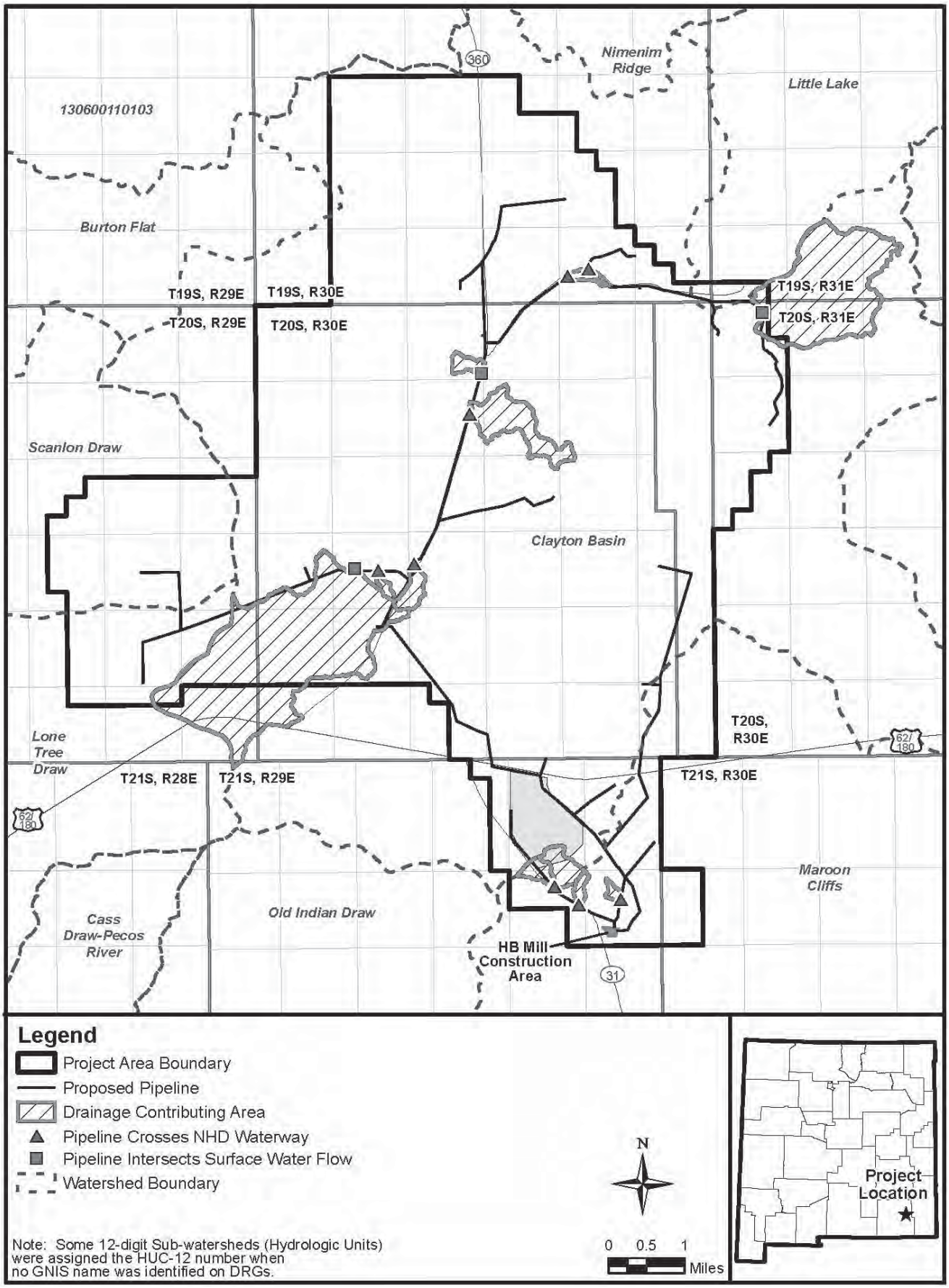


Figure 4.3-5. Drainage Points at Proposed Surface Pipelines under Proposed Action

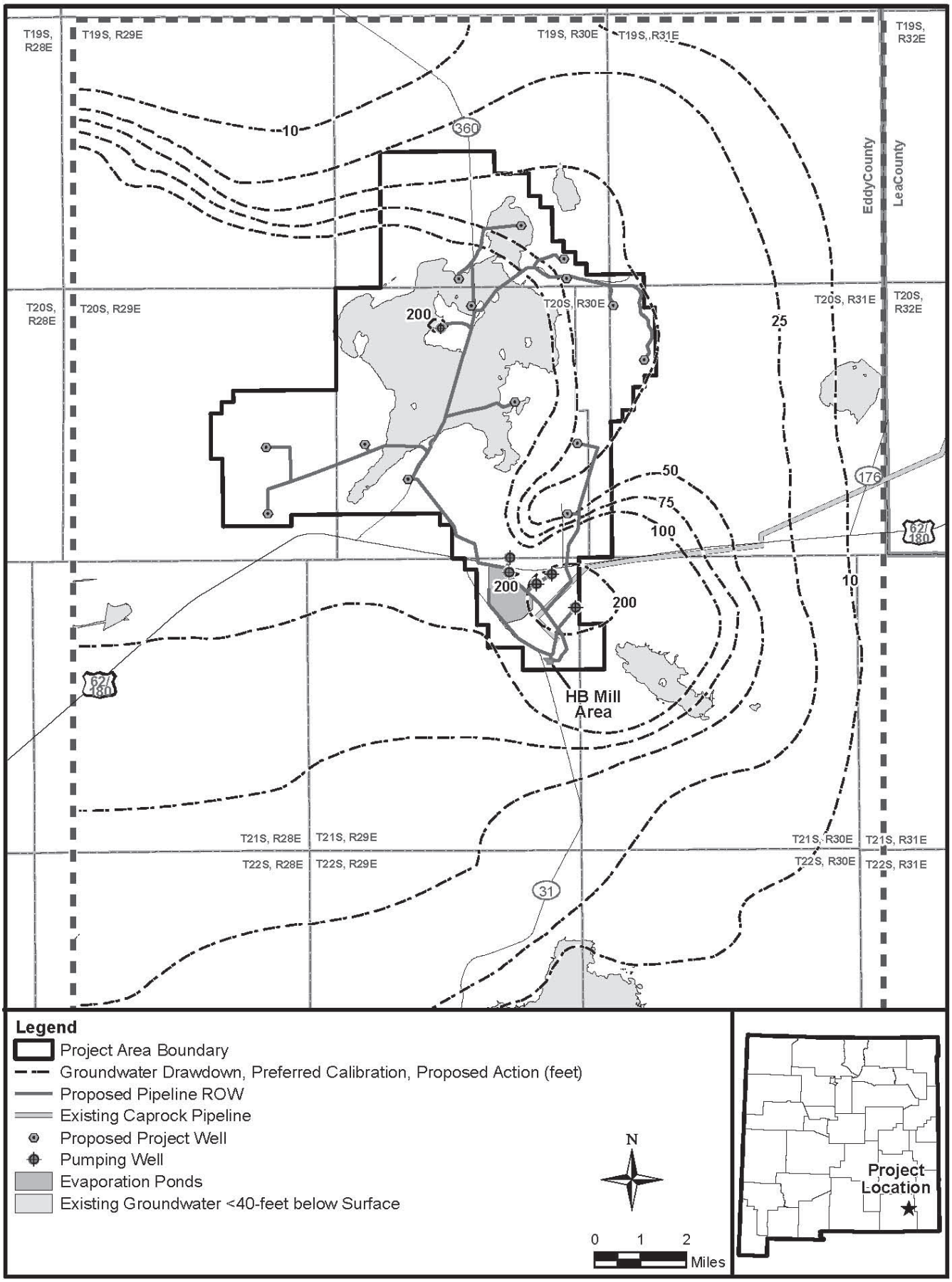


Figure 4.3-6. Groundwater Drawdown, Rustler Preferred Model under Proposed Action

Groundwater wells in the Rustler area would be impacted by drawdown ranging from approximately 50 feet to 200 feet. Well depth and water column data indicate that two out of three wells in the area would be drawn down below operational levels at some time during project pumping.

Rustler Enhanced Model

Figure 4.3-7 projected drawdown of the existing groundwater surface that was predicted by the Rustler Enhanced model. The maximum sustainable pumping rate under this scenario would be 1,440 gpm from the Rustler North wells and 670 gpm from the Rustler South wells. Maximum drawdown from this model was similar to the Preferred model, but the areal extent of the 200-foot drawdown was significantly larger (approximately 3 times larger) in the Rustler South area due to the elevated hydraulic conductivities and higher pumping rate. The total area of 200-foot drawdown is approximately 6,500 acres. The 10-foot drawdown contour extends from the project area boundary approximately 6.5 miles to the south, 4 miles to the east, 2 miles to the north, and to the no-flow boundary in the west. These distances are slightly further when compared to the Preferred model.

The impacts from the Rustler Enhanced model indicate that modeled groundwater contributions to springs and seeps in the calibrated model would decrease from 3,014 gpm to 1,085 gpm, a reduction of 64 percent. Groundwater flow to Nash Draw would decrease from 306 gpm to 200 gpm, a reduction of 35 percent, which indicates that there may be reduced flows into the Pecos River.

Groundwater use impacts in the project area would be more extensive than those of the Preferred model.

Caprock Model

Figure 4.3-8 depicts drawdown of the existing groundwater levels that was predicted by the Caprock time-weighted model. Maximum drawdown from this model was 8 feet in the area directly south of the East Caprock well field.

Usage of Caprock water would be low because Caprock water would only be used for processing at the HB mill (up to a maximum of 267 gpm), so water use impacts in the Caprock area would be minimal under the Proposed Action. No wells in the vicinity would experience a drawdown of greater than 10 feet. No drawdown would be expected to affect the Lovington municipal wells.

Summary of Groundwater Pumping under the Proposed Action

Under the Proposed Action, it appears that Intrepid may be able to get the water needed for the project as injectate from the Magenta and Culebra members of the Rustler Formation. Most of this Rustler water would come from the Rustler North area in Clayton Basin. In order for Intrepid to obtain 2,000 gpm, the fracture system in the Section 2 area would have to be well integrated and capable of yielding 670 gpm for at least 7 years. If this is not the case, then Intrepid would have only around 1,500 to 1,600 gpm for injectate water during the first 7 years of mine life (Phase I). **Table 4.3-2** summarizes the results of the models to quantify potential impacts.

The potential for decreased groundwater supply to springs, seeps, and Nash Draw would be greatest if the conditions characterized in the Rustler Enhanced groundwater model exist, but the impacts also would be significant under the conditions characterized by the Rustler Preferred groundwater model. It is possible that the reduced groundwater flows from Nash Draw caused by project pumping may significantly reduce inflow into the Pecos River. However, due to the distance between Nash Draw and the Pecos River, the climate, and dry soil conditions, it is impossible to determine whether the river flows would be reduced and by how much.

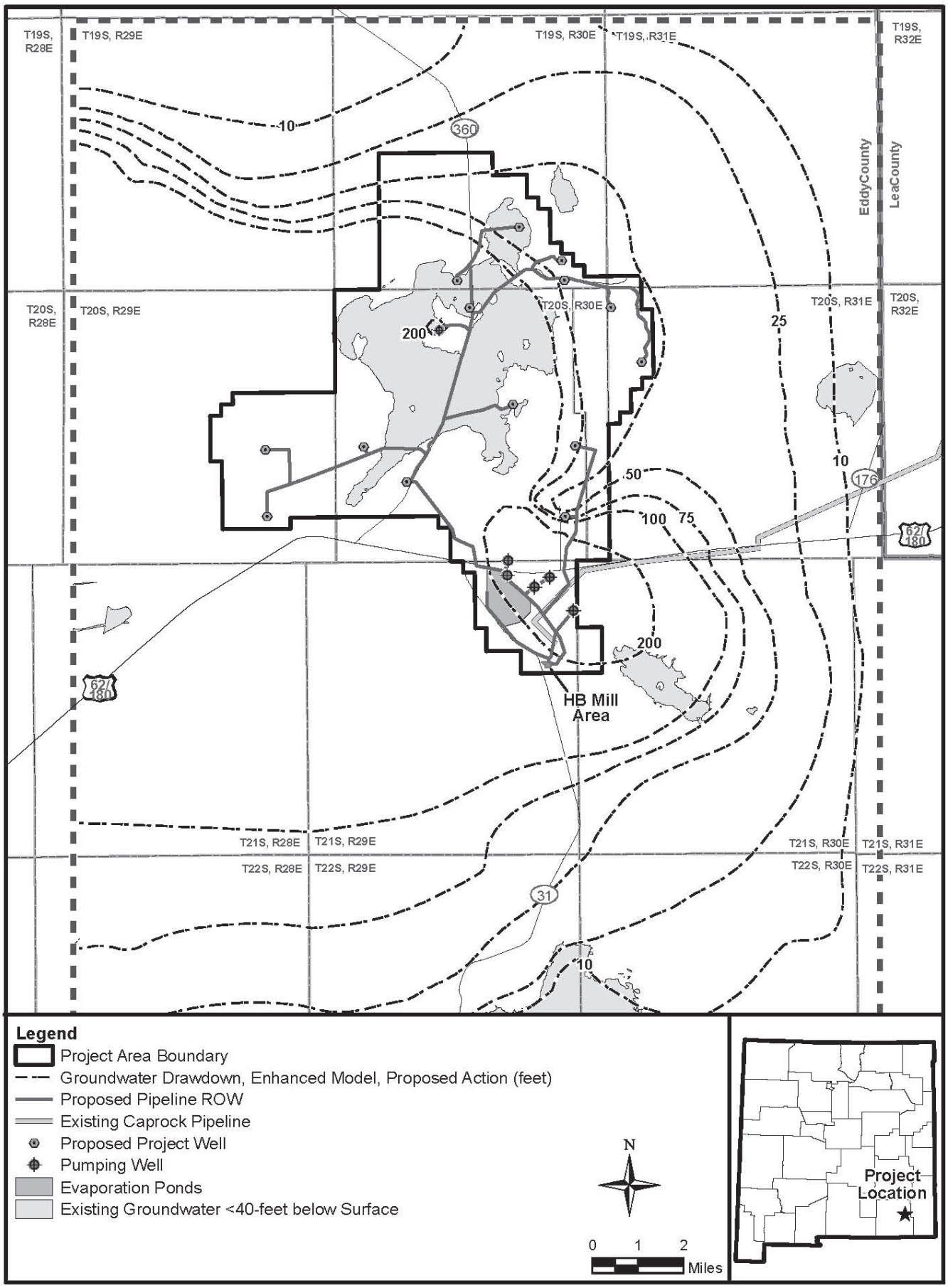


Figure 4.3-7. Groundwater Drawdown, Rustler Enhanced Model under Proposed Action

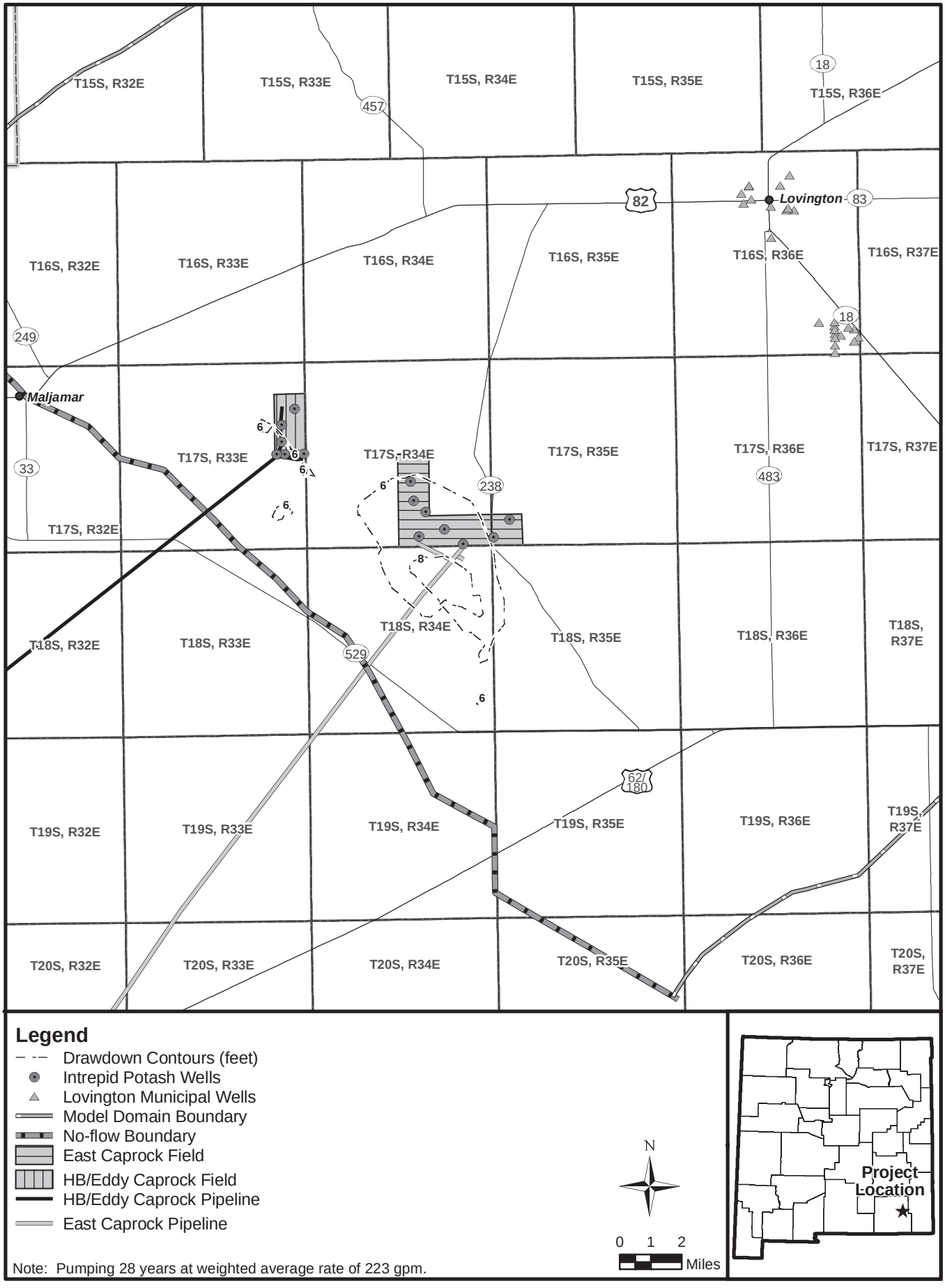


Figure 4.3-8 Groundwater Drawdown in Caprock Area, Proposed Action (Time-weighted Average)

Table 4.3-2 Summary of Results from Groundwater Models for the Proposed Action

Proposed Action	Rustler Preferred		Rustler Enhanced		Caprock	
	North	South	North	South	Maximum	Time-Weighted
Pumping Rate (gpm)	1,440	177	1,440	670	N/A	223
Drawdown (ft)	200	200	200	200	N/A	8
Spring/Seep Flux Reduction	61%		64%		N/A	—
Southern Flux Reduction[1]	25%		35%		N/A	—
Drawdown @ Lovington Wells	—		—		N/A	0

[1] Indicates change in flows out of Nash Draw.

Evaporation Ponds

The evaporation ponds would have a compacted clay base and a geosynthetic liner to prevent seepage to groundwater. In addition, above the geosynthetic liner would be a layer of hardened salt that would protect the liner from damage caused by scraping the precipitated potash. The salt layer combined with the geosynthetic liner would prevent seepage loss from the evaporation ponds and protect groundwater quality. Monitoring wells would be checked on a regular basis and would detect leaks from the ponds so the system could be repaired quickly should leaks occur. No adverse impacts to groundwater quantity or quality are expected to occur due to seepage from the evaporation ponds.

4.3.6 Alternative B

4.3.6.1 Surface Water

Impacts to surface water in the project area would be similar to that described for the Proposed Action. Differences include less surface disturbance in the project area because the Rustler North wells and associated pipeline would not be installed, and more surface disturbance outside the project area to replace the existing Caprock pipelines or install the new Caprock pipeline. The water supply pipeline construction disturbance would continue outside the project area between it and the Caprock well fields. The existing Caprock pipelines cross through 16 subwatersheds. The new Caprock pipeline would cross through 10 subwatersheds.

Initial disturbance from replacement of the existing Caprock pipelines would be 400 acres. Because the supplemental water source supply pipelines would be buried, no long-term impacts would be anticipated after complete reclamation is achieved. The new Caprock pipeline would cause 279 acres of initial disturbance and 84 acres of long-term disturbance due to construction of an access road.

Impacts in the project area associated with facilities near 100-year floodplains and alkali lakes, aboveground pipeline installation, and crossings of drainageways would be the same as those under the Proposed Action.

4.3.6.2 Groundwater

Impacts to groundwater were analyzed under three distinct scenarios for this alternative. Water withdrawal from the Rustler South area was evaluated using the Preferred and Enhanced models, with withdrawal from the Caprock well fields supplementing the Rustler water under each of these two scenarios. The third scenario modeled obtaining all proposed project water from the Caprock area. The models were used to predict groundwater drawdown in their respective areas.

Rustler Preferred Model

Figure 4.3-9 depicts contours of projected drawdown of the existing groundwater surface that was predicted by the Rustler Preferred model. The maximum sustainable pumping rate under this scenario would be 177 gpm from the Rustler South wells, with no pumping from the Rustler North wells. The results indicate that maximum drawdown in the project area would occur in the area surrounding the South Rustler wells and would exceed 200 feet of drawdown below the existing groundwater elevations in the area. The total area of 200-foot drawdown is approximately 1,450 acres. The 10-foot drawdown contour extends beyond the project area boundary approximately 5.5 miles to the south, 3.5 miles to the east, crosses the middle of Clayton Basin to the north, and to the no-flow boundary in the west.

The impacts from the Rustler Preferred model under this scenario indicate that modeled groundwater contributions to springs and seeps in the calibrated model would decrease from 3,014 gpm to 2,790 gpm, a reduction of 7 percent. Groundwater flow to Nash Draw would decrease from 306 gpm to 272 gpm, a reduction of 11 percent, which indicates that there may be reduced flows into the Pecos River.

Water use impacts in the Rustler area would be less than under the Proposed Action because the Rustler North area would not be pumped. Under this alternative and scenario, all the domestic and livestock wells of record in the area would fall outside the 10-foot drawdown contour.

Caprock Model (and Rustler Preferred)

Maximum drawdown impacts are displayed on **Figure 4.3-10** and reflect the projected drawdown of the current groundwater levels during maximum pumping of the Caprock well fields, a situation that would occur to achieve the stated maximum pumping rate of 2,000 gpm for the first 7 years of the project (Phase I). **Figure 4.3-11** displays the maximum drawdown under the time-weighted average scenario, Maximum drawdown from this model was 54 feet in the area directly south of the East Caprock well field, with approximately 12 feet of drawdown at the Lovington municipal well field approximately 11 miles to the northeast.

The time-weighted drawdown, displayed on **Figure 4.3-11**, reflects the drawdown that would occur over the life of the project (28 years). The maximum drawdown from current groundwater levels would be 24 feet over the life of the project. The 10-foot drawdown contour would extend to within approximately 5 miles from the Lovington municipal wells.

Groundwater pumping under this alternative would include a 100-foot or greater maximum drawdown at all 373 wells identified within three miles of the Caprock well fields during Year 7 of the Project (Phase I). The Lovington municipal wells would experience a maximum drawdown of 12 feet at that time, with a sustained drawdown of less than 10 feet for the life of the project. This amount of drawdown would not adversely affect the other Caprock wells in this area.

Rustler Enhanced Model

Figure 4.3-12 depicts projected drawdown of the existing groundwater surface that was predicted by the Rustler Enhanced model under Alternative B. The maximum sustainable pumping rate under this scenario would be 670 gpm from the Rustler South wells. Maximum drawdown from this model was similar to the Preferred model, but the areal extent of the 200-foot drawdown was significantly larger (approximately 3 times larger) in the Rustler South area due to the elevated conductivities and higher pumping rate assumed. The total area of 200-foot drawdown is approximately 4,750 acres. The 10-foot drawdown contour extends from the project area boundary approximately 6 miles to the south, 4 miles to the east, through the southern side of the project area to the north, and to the no-flow boundary in the west. These distances are slightly further when compared to the Preferred model. The impacts from the

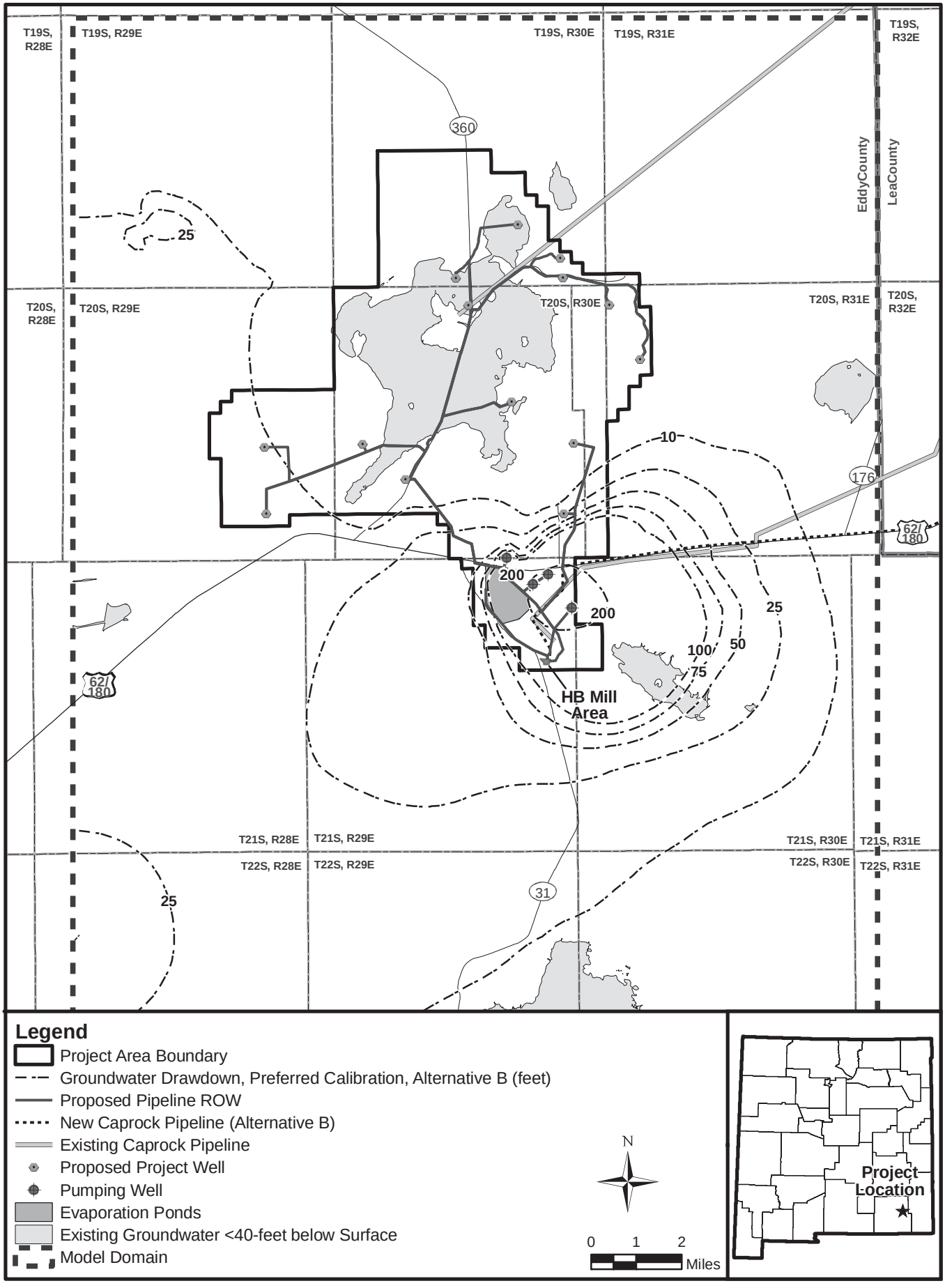


Figure 4.3-9 Groundwater Drawdown, Rustler Preferred Model under Alternative B

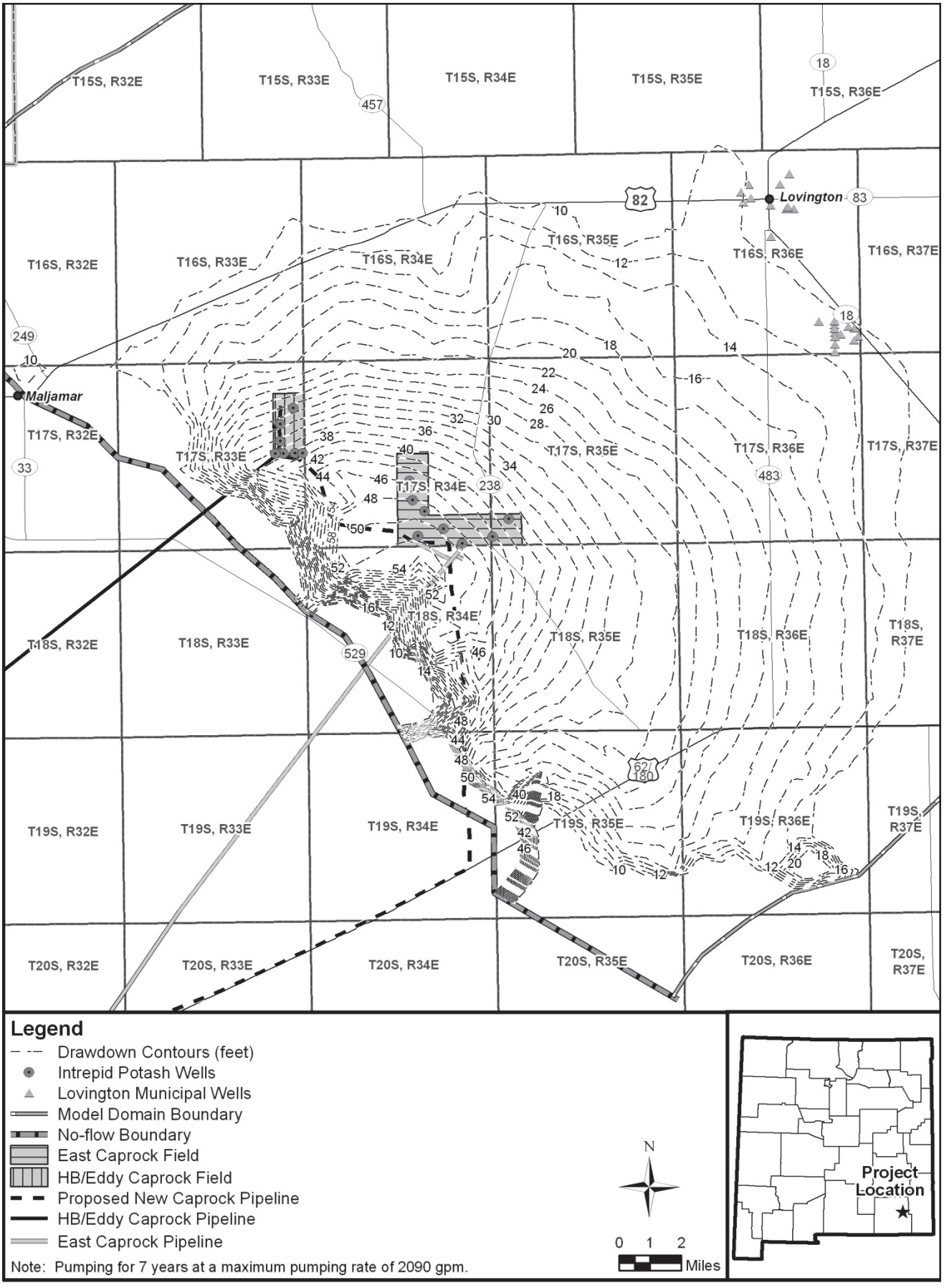


Figure 4.3-10. Groundwater Drawdown in Caprock Area, Alternative B—Maximum Pumping with Rustler Preferred Model

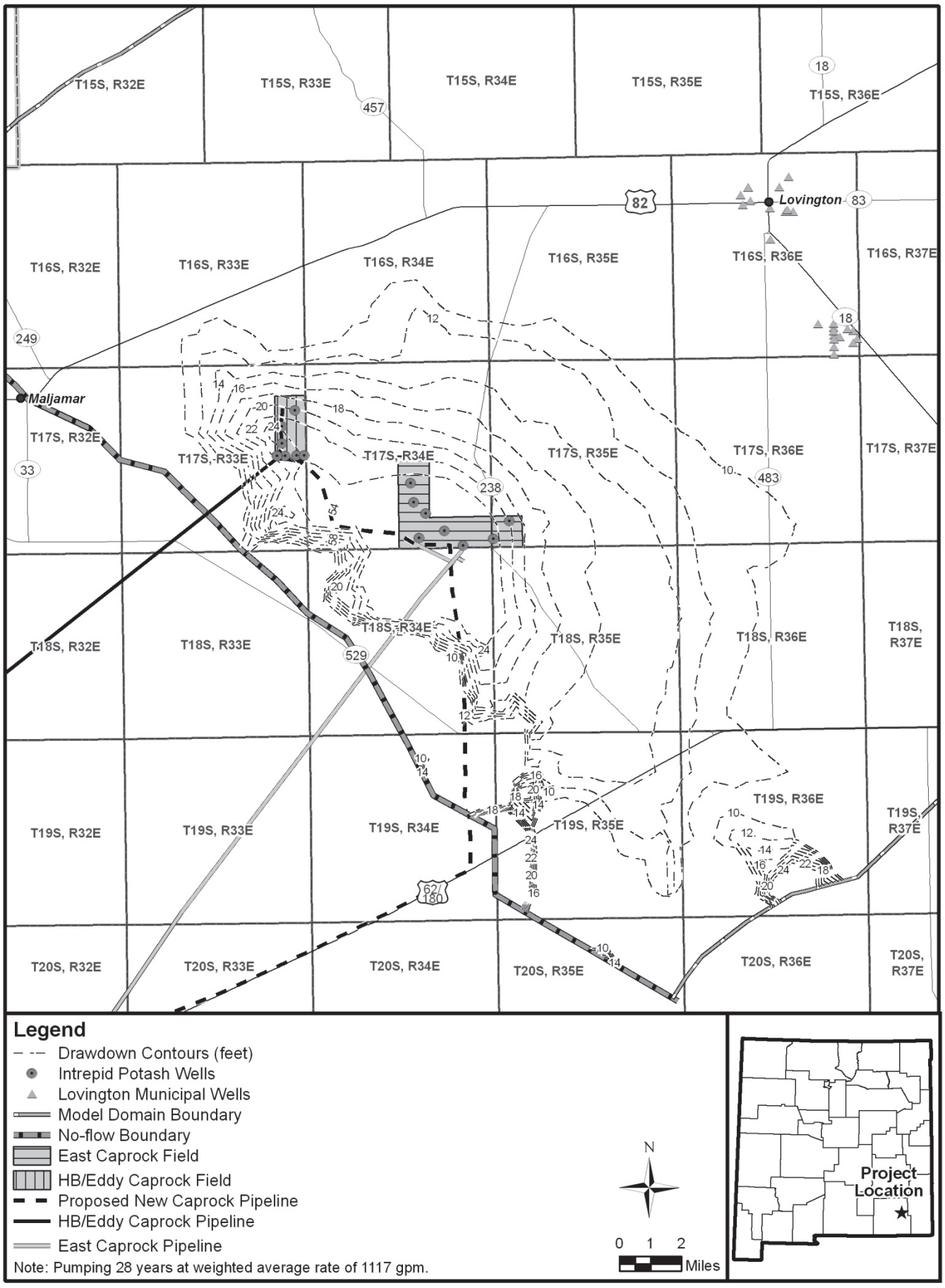


Figure 4.3-11. Groundwater Drawdown in Caprock Area, Alternative B—Time-weighted Average with Rustler Preferred Model

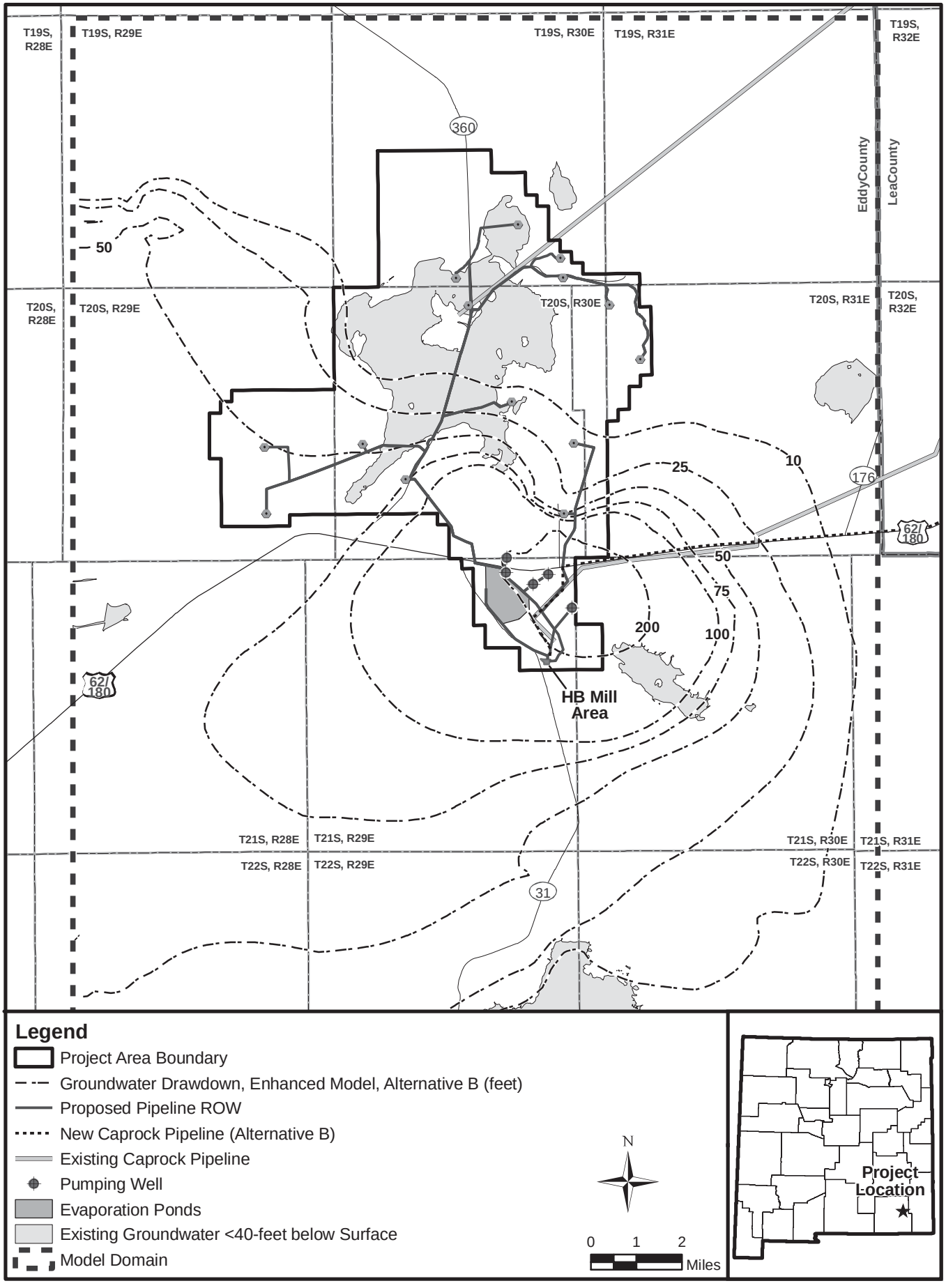


Figure 4.3-12 Groundwater Drawdown, Rustler Enhanced Model under Alternative B

Rustler Enhanced model under this scenario indicate that modeled groundwater contributions to springs and seeps in the calibrated model would decrease from 3,014 gpm to 2,070 gpm, a reduction of 31 percent. Groundwater flow to Nash Draw would decrease from 306 gpm to 228 gpm, a reduction of 25 percent, which indicates that there may be reduced flows into the Pecos River. Impacts to water use would be similar to those of the Alternative B, Preferred model.

Caprock Model (and Rustler Enhanced)

Maximum drawdown impacts are displayed on **Figure 4.3-13** and reflect the projected drawdown of the current groundwater levels during maximum pumping of the Caprock well fields to supplement pumping in the Rustler South area, a situation that would occur to achieve the stated maximum pumping rate of 2,000 gpm for the first 7 years of the project (Phase I). **Figure 4.3-14** displays the drawdown in the Caprock area that is predicted by the time-weighted average to reflect the total drawdown that would occur in the Caprock area over the 28-year life of the project. Maximum drawdown from this model was 46 feet in the area directly south of the East Caprock well field, with the 10-foot drawdown contour extending to within approximately 1 mile of the Lovington municipal wells. The time-weighted drawdown maximum indicates 20 feet of drawdown could be expected over the life of the project, and the 10-foot drawdown contour decreases toward the Caprock well fields, extending to within approximately 9 miles from the Lovington municipal wells.

Groundwater pumping under this alternative would include a 10 foot or greater maximum drawdown at all 373 wells identified within 3 miles of the Caprock well fields during Year 7 of the project (Phase I). The Lovington municipal wells would experience a maximum drawdown of less than 10 feet at that time, with a sustained drawdown of less than 10 feet for the life of the project. This amount of drawdown would not adversely affect the other Caprock wells in this area.

Caprock Model (Caprock Only)

Maximum drawdown impacts are displayed on **Figure 4.3-15** and reflect the projected drawdown of the current groundwater levels during maximum pumping of the Caprock well fields to achieve the stated maximum pumping rate of 2,000 gpm for the first 7 years of the project (Phase I) without any pumping of Rustler wells. **Figure 4.3-16** displays the drawdown in the Caprock area that is predicted by the time-weighted average to reflect the total drawdown that would occur in the Caprock area over the 28-year life of the project. Maximum drawdown from this model was 62 feet in the area directly south of the East Caprock well field, with approximately 13 feet of drawdown at the Lovington municipal wells. The time-weighted drawdown maximum indicates 34 feet of drawdown could be expected over the life of the project, and the 10-foot drawdown contour decreases toward the Caprock well fields, extending to within approximately 4 miles from the Lovington municipal wells.

Groundwater pumping under this alternative would include a 10-foot or greater maximum drawdown at all 373 wells identified within 3 miles of the Caprock well fields during Year 7 of the project (Phase I). The Lovington municipal wells would experience a maximum drawdown of 13 feet at that time, with a sustained drawdown of less than 10 feet for the life of the project. This amount of drawdown would not adversely affect the other Caprock wells in this area.

Summary of Groundwater Pumping under Alternative B

Under Alternative B, it appears that Intrepid would be able to get the water needed for the project from the Caprock well fields with minimal adverse impacts to other wells in the surrounding area. The use of Rustler wells to supply injectate from the Magenta and Culebra members of the Rustler Formation would come from the Rustler South area. If the Rustler South area only yields the water according to the pumping rate assumed for the Preferred model, Caprock water could be used as a supplementary source to maintain the maximum 2,000 gpm rate needed to fill the flood pools at the maximum rate

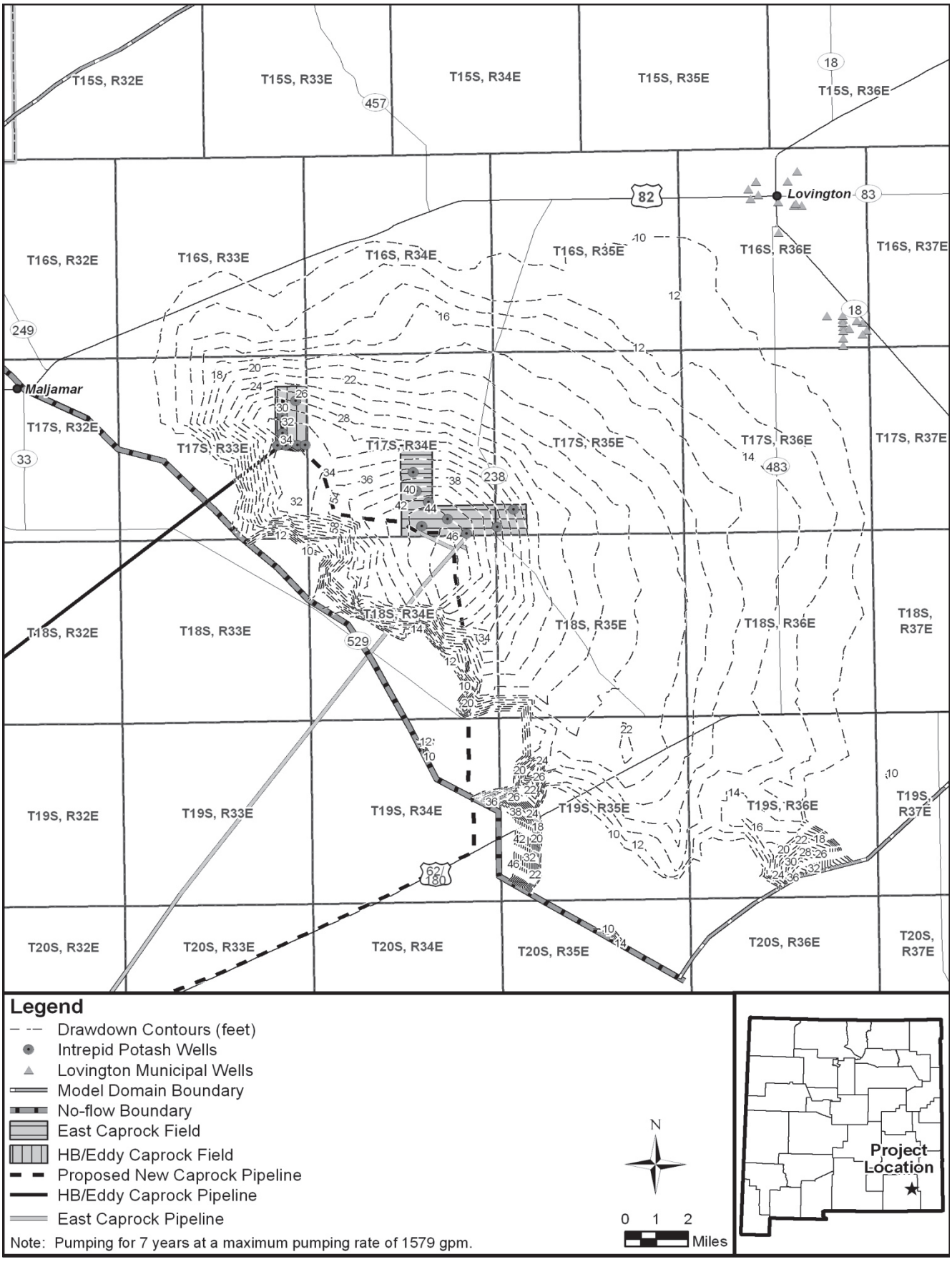


Figure 4.3-13. Groundwater Drawdown in Caprock Area, Alternative B—Maximum Pumping with Rustler Enhanced Model

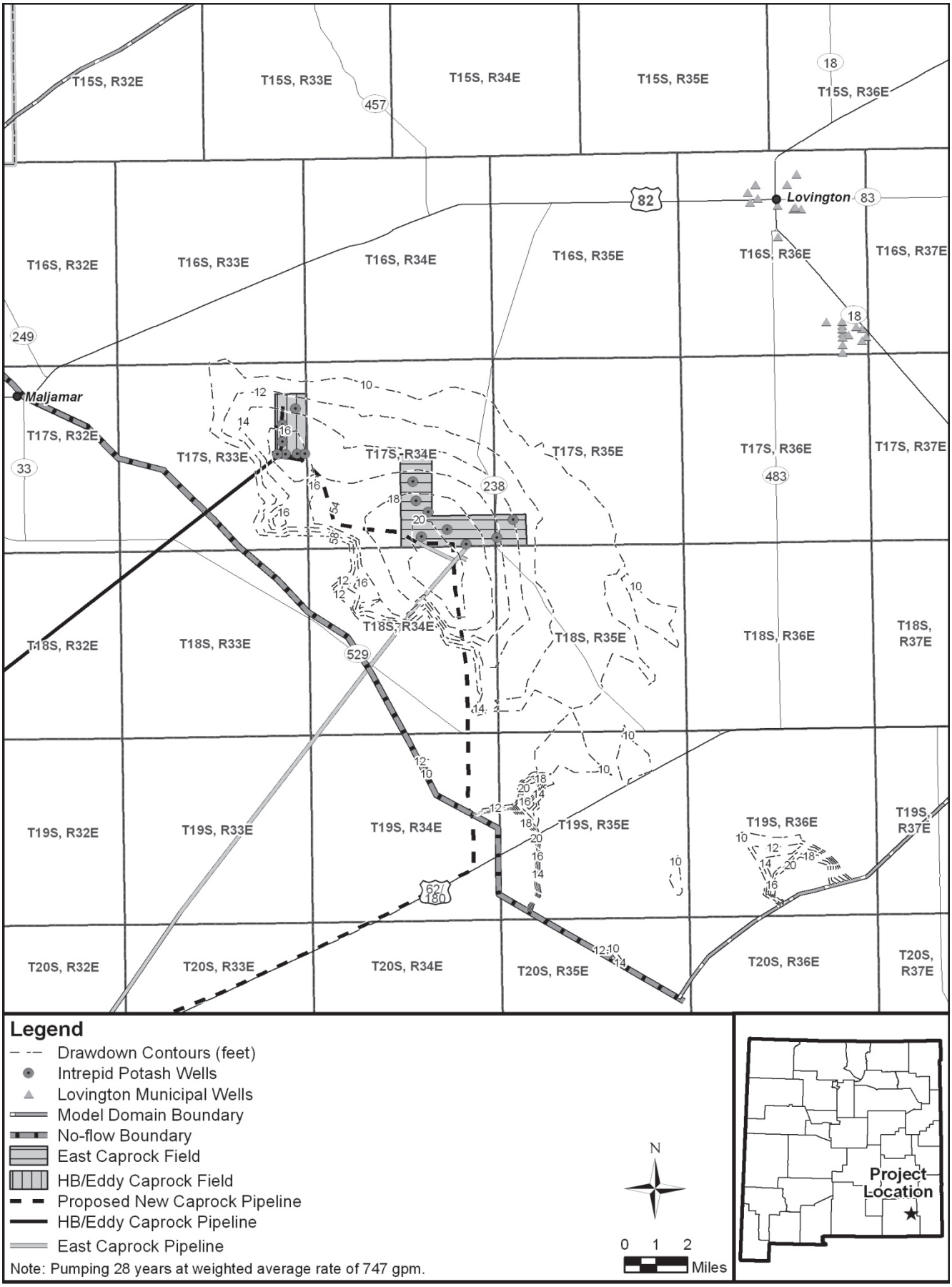


Figure 4.3-14. Groundwater Drawdown in Caprock Area, Alternative B—Time-weighted Average with Rustler Enhanced Model

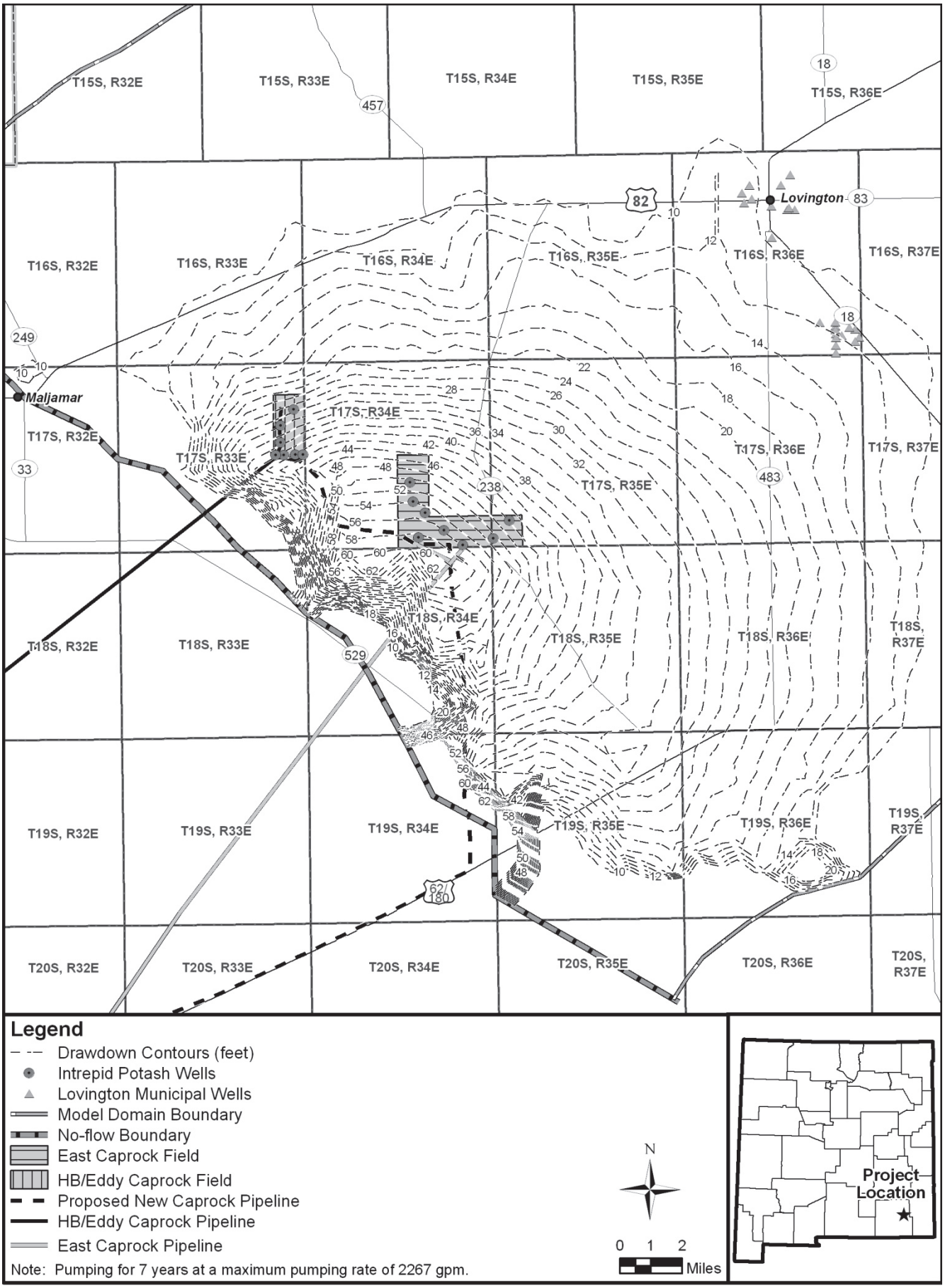


Figure 4.3-15. Groundwater Drawdown in Caprock Area, Alternative B—Maximum Pumping, Pumping Caprock Only

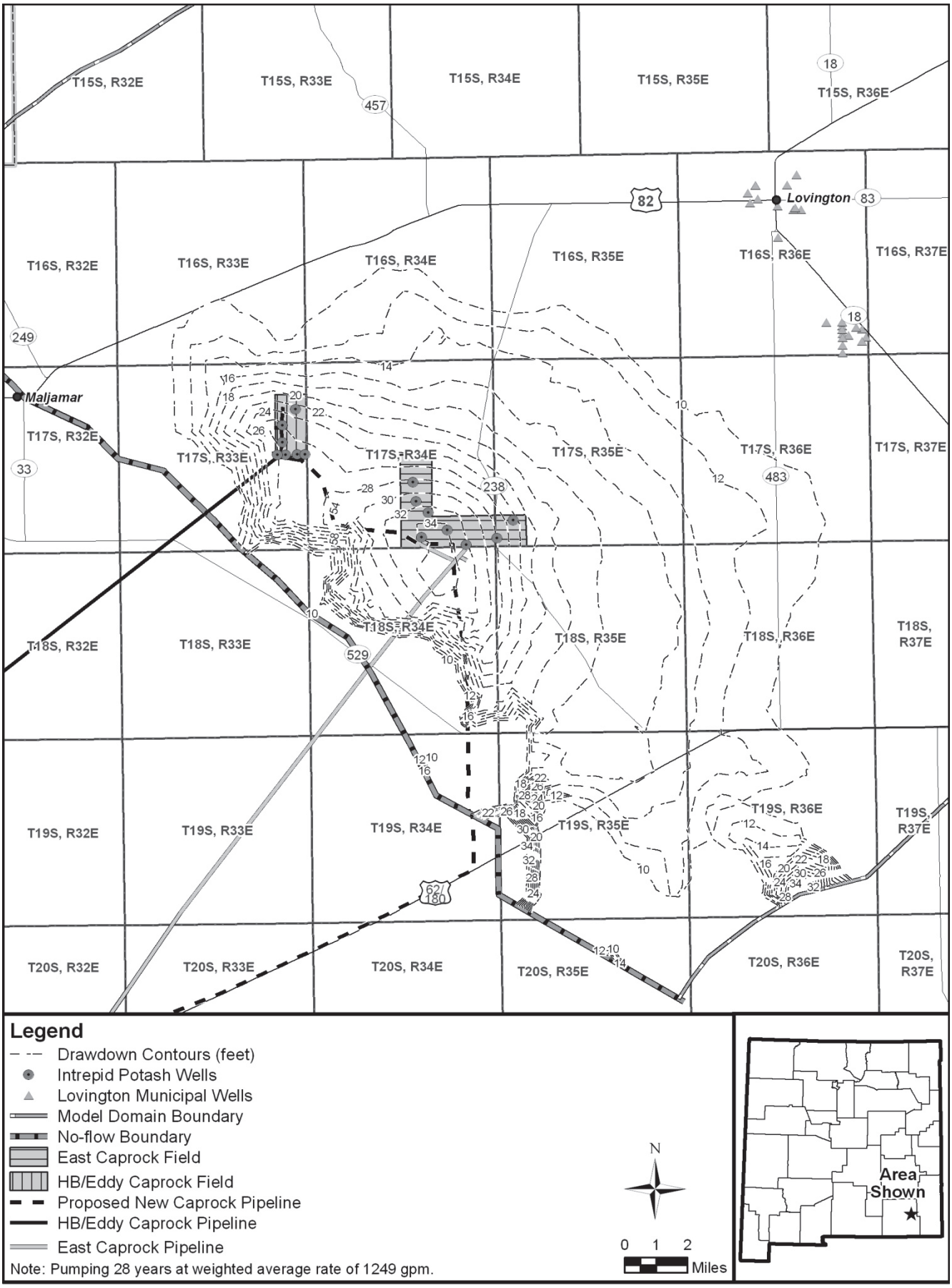


Figure 4.3-16. Groundwater Drawdown in Caprock Area, Alternative B—Time-weighted Average, Pumping Caprock Only

desired by Intrepid. If the Rustler Formation water supply is inconsistent, the Caprock well fields could supply all of the required project water. If the maximum amount of water was derived from the Caprock area for Phase I (7 years) of the proposed project (3,226 acre-feet), this water usage would be approximately 20 percent of Intrepid's total allowable water rights from the Caprock wells and almost 2 percent of the total Lea County water usage in 2005. When considered in combination with Intrepid's existing Caprock water usage from 2009 (5,051 acre-feet), the total water right used would be approximately 51 percent of the allowable diversion for the existing Caprock well field, or approximately 4 percent of the total Lea County water usage in 2005.

The potential for decreased groundwater supply to project area springs, seeps, and Nash Draw would be greatest if the conditions characterized in the Rustler Enhanced groundwater model exist, and much less under the conditions characterized by the Rustler Preferred groundwater model. No change to groundwater that supplies project area springs, seeps, and Nash Draw would result if only Caprock water were pumped. It is possible that the reduced groundwater flows from Nash Draw caused by pumping of the Rustler may significantly reduce inflow into the Pecos River, but the reduction would be less than under the Proposed Action. However, due to the distance between Nash Draw and the Pecos River, the climate, and dry soil conditions, it is impossible to determine whether the river flows would be reduced and by how much. **Table 4.3-3** summarizes the results of the pumping effects predicted by the Rustler and Caprock groundwater models under Alternative B.

Table 4.3-3 Summary of Results from Groundwater Models for Alternative B

	Rustler Preferred		Rustler Enhanced		Caprock	
	Northern	Southern	Northern	Southern	Maximum	Time-Weighted
Alternative B - Rustler South Preferred & Caprock						
Max. Pumping Rate (gpm)	—	177	—	—	2,090	1,117
Max. Drawdown (ft)	—	200	—	—	54	24
Spring/Seep Flux Reduction	7%		—		—	—
Southern Flux Reduction	11%		—		—	—
Drawdown @ Lovington Wells (ft)[1]	—		—		12	<10 (@ 5 mi)
Alternative B - Rustler South Enhanced & Caprock						
Pumping Rate (gpm)	—	—	—	670	1,579	747
Drawdown (ft)	—	—	—	200	46	20
Spring/Seep Flux Reduction	—		31%		—	—
Southern Flux Reduction[1]	—		25%		—	—
Drawdown @ Lovington Wells (ft)[2]	—		—		<10 (1 mi)	<10 (@9 mi)
Alternative B - Caprock Only						
Pumping Rate (gpm)	—	—	—	—	2,267	1,249
Drawdown (ft)	—	—	—	—	62	34
Spring/Seep Flux Reduction	—		—		—	—
Southern Flux Reduction	—		—		—	—
Drawdown @ Lovington Wells (ft)[1]	—		—		13	<10 (@4 mi)

[1] Indicates change in flows out of Nash Draw.

[2] Value in Parentheses (X) indicates distance from Lovington wells to 10-foot drawdown contour.

4.3.7 Alternative C

4.3.7.1 Surface Water

Under this alternative, potential impacts from temporary disturbance would remain the same as the proposed alternative. Although the roads would still remain disturbed during operation, the pipelines would be buried and potential impacts from long-term disturbance would decrease following surface reclamation.

4.3.7.2 Groundwater

Impacts to groundwater would be the same as those described under the Proposed Action.

4.3.8 Alternative D—Preferred Alternative

Under this alternative, the impacts to water resources would be similar to those described for Alternative B, with the exception of a few differences regarding the pipeline location within the project area, shown on **Figure 4.3-17**, and the burial of most of the pipelines that would be on the surface under Alternatives A and B. As a result of the pipeline burial, potential impacts from long-term surface disturbance would decrease. There would be six locations where surface pipelines would potentially cross drainages. **Table 4.3-4** details the project-related disturbance within subwatersheds in the project area under the Preferred Alternative. In addition to surface disturbance in the project area, the installation of the Caprock pipeline would result in initial surface disturbance of approximately 285 acres across 10 subwatersheds and long-term bare ground for the access road along the pipeline of approximately 85 acres in the same subwatersheds.

Table 4.3-4 Project-related Disturbance within Subwatersheds in Project Area under the Preferred Alternative

Subwatershed Name	Initial Disturbance (acres)		Long-term Disturbance (acres)	
	Total	% HUC	Total	% HUC
Little Lake	14	<0.1	12	<0.1
Clayton Basin	906	1.7	772	1.5
Scanlon Draw	7	<0.1	1	<0.1
Lone Tree Draw	24	<0.1	14	<0.1
Maroon Cliffs	120	0.3	68	0.2
Total	1,071	0.7	882	0.7

Project well site acreage is included in pipeline ROW acreage.

ROW includes project pipelines, wells, roads, lift/pump stations, and power lines.

Totals in table include only acreage within the project area, excluding Caprock pipeline.

Impacts to groundwater due to pumping would be the same as those described for Alternative B.

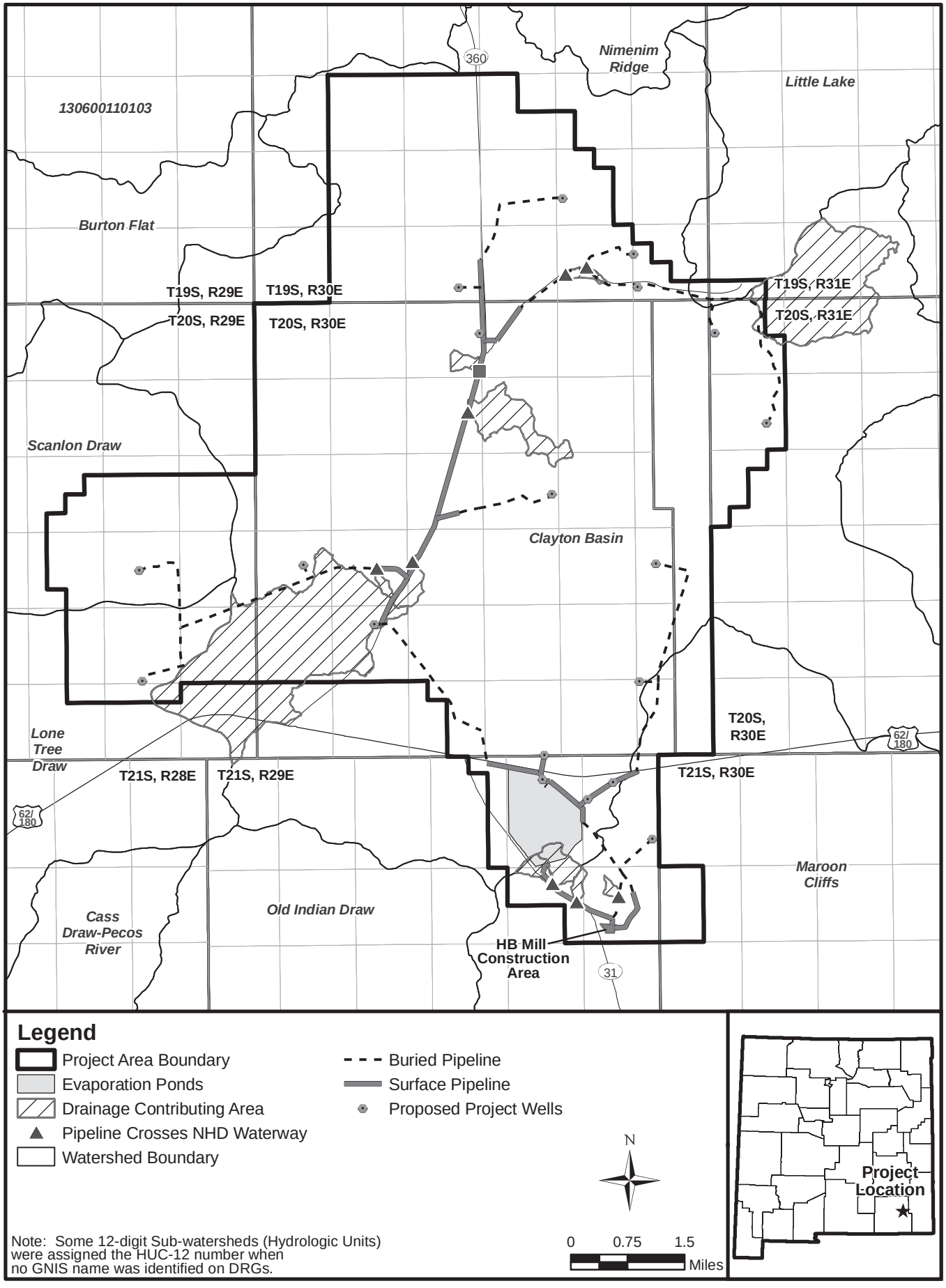


Figure 4.3-17 Drainage Points at Proposed Surface Pipelines under Preferred Alternative

4.3.9 Mitigation Measures

Pipeline construction would comply with BLM environmental protection measures (**Table 2-9**) and associated culvert measures for road construction. Recommended additional mitigation measures include the following.

- Where surface pipelines cross existing drainages or intersect points with large contributing drainage areas, the pipelines should be buried below potential scour depth and stabilized with rock to minimize the potential for erosion.
- If the Rustler North area wells are pumped, the water extracted should be treated to remove the lead before it is combined with other water sources and used for injectate in the flood pools.
- A mitigation plan to minimize impacts to groundwater resources should be developed to identify potential measures to reduce groundwater drawdown such as water conservation improvements.

4.3.10 Summary of Impacts

4.3.10.1 Surface Water

Table 4.3-5 summarizes the acreage disturbed that may affect surface water bodies.

Table 4.3-5 Summary of Impacts to Surface Water Resources

Disturbance	No Action	Proposed Action	Alternative B	Alternative C	Preferred Alternative
Construction	None	1,022 acres	1,435 acres	1,022 acres	1,331 acres
Operation	None	829 acres	914 acres	829 acres	961 acres

4.3.10.2 Groundwater

The Proposed Action would draw down groundwater potentiometric surfaces in the Rustler North and South areas of the project area by approximately 200 feet. Groundwater contributions to seeps, springs, and underflow to Nash Draw would decrease from current conditions due to project-related drawdown. The Caprock Area would experience 8 feet of drawdown over the life of the project. No drawdown would occur at the Lovington municipal wells. Pumping under the Proposed Action scenarios would have the greatest potential impact to springs, seeps, and Nash Draw and possibly to the Pecos River.

Under Alternative B, drawdown in the Rustler Area would be less than under the Proposed Action, while drawdown in the Caprock area would be greater. Groundwater contributions to seeps, springs, and underflow to Nash Draw would decrease from current conditions but the depletion would be less than under the Proposed Action. Increased drawdown in the Caprock area also would slightly increase drawdown at the Lovington municipal wells.

Under Alternative C, groundwater impacts would be the same as those of the Proposed Action.

Under the Preferred Alternative, groundwater impacts would be the same as those of Alternative B.

Table 4.3-6 summarizes the impacts to groundwater under all alternatives.

Table 4.3-6 Summary of Impacts to Groundwater Resources Under All Alternatives

	No Action	Proposed Action	Alternative B	Alternative C	Preferred Alternative
Pumping Rate	None	1,884 gpm to 2,267 gpm	2,267 gpm	1,884 gpm to 2,267 gpm	2,267 gpm
Maximum Rustler Area Drawdown	None	200 feet	200 feet	200 feet	200 feet
Seep/Spring Contribution Reduction	None	61% to 64%	7% to 31%	61% to 64%	7% to 31%
Nash Draw Contribution Reduction	None	25% to 35%	11% to 25%	25% to 35%	11% to 25%
Maximum Caprock Area Drawdown	None	8 feet	46 feet to 52 feet	8 feet	46 feet to 52 feet
Time-weighted Caprock Area Drawdown	None	8 feet	20 feet to 34 feet	8 feet	20 feet to 34 feet
Maximum Lovington Municipal Wells Drawdown	None	None	13 feet to less than 10 feet	None	13 feet to less than 10 feet
Time-weighted Lovington Municipal Wells Drawdown	None	None	less than 10 feet	None	less than 10 feet

4.4 Soils

The following impact analysis focuses on soil resources that may be affected by construction and operation of the proposed project. This section includes an overview of scoping issues identified for soil resources, impact assessment assumptions and methodologies, and proposed additional mitigation measures, as applicable, that would minimize or mitigate potential significant impacts.

4.4.1 Issues

Issues related to soil resources as identified during the scoping process include the following:

- Successful reclamation of soils is important to maintain productivity and stability.
- Concern for possible soil contamination associated with potential spills of salt brine thereby affecting reclamation potential.

4.4.2 Method of Analysis

Potential impacts to soil resources were investigated by examining the soil types, their extent, and their physical and chemical characteristics in relation to the locations of surface disturbance under each alternative. Using GIS, the SSURGO spatial data (NRCS 2008a) was overlaid with the locations of proposed ROWs and other facilities to identify the soil map units that would be disturbed. The tabular soil database was used to identify the acreage and locations of soils that would be disturbed under each alternative and to summarize selected limitations of the soil map units as described below.

- The acreage of soils with severe hazards and limitations was calculated to quantify the amount of aggressive environmental protection measures and monitoring.
- The soil characteristics and acreage of soils initially disturbed by construction were identified because these areas would be likely to have accelerated erosion in the short-term, until interim reclamation is implemented.
- The soil characteristics and acreage of soils to be left bare or in an altered state for the life of the project (such as surfaced roads and areas around well pads) were identified as areas with the potential for erosion if unstabilized.

4.4.3 Assumptions

Analysis was based on the following assumptions:

- Direct effects on soils would occur primarily due to the physical disturbance of the upper soil layers and the disruption of soil biological processes, caused by activities that alter the natural soil layers or result in accelerated erosion, increased soil compaction, loss of protective vegetation, and loss of soil productivity.
- Indirect effects on soils include reduced surface water infiltration, an associated increase in surface water runoff, and poor plant growth or seed germination.
- Bare soil (without vegetation or other surface cover) with a surface layer that has been altered from its natural condition is more susceptible to accelerated wind and water erosion than undisturbed soil.
- Any surface disturbance has the potential to degrade soil quality and productivity because it damages the biological soil crust and exposes the bare soil to the erosive forces of wind and water until revegetation or other ground cover is established.
- Erosion from disturbed areas would be minimal once vegetation is reestablished. Successful establishment of vegetation generally takes a minimum of 3 years, depending on soil and precipitation, and requires monitoring during this time.
- Surface disturbance from construction would modify soils by disrupting soil stability, changing vegetative cover that can reduce nutrient recycling, damaging biological crusts, decreasing productivity, and increasing compaction.
- When surface disturbance occurs on highly erodible soils, the potential for accelerated erosion is greater than on less erodible soils. Sensitive soils would incur greater adverse impacts from surface-disturbing activities than non-sensitive soils. Sensitive soils include those that are highly erodible, have a high pH, high salinity or sodicity, have a high clay content, or have a low reclamation potential.
- The New Mexico Standards for Public Land Health (BLM 2001) provide minimum standards for vegetation health, vigor, soil cover, and erosion rates that apply to all BLM administered activities.
- The risk of BMP failure is greater on highly erodible soils. To be effective on highly erodible soils, more extensive BMPs and more aggressive maintenance techniques than those commonly used are often required.
- Applicant-committed measures and standard BMPs would be successfully implemented, monitored, and maintained.
- Erosion on the landscape may contribute to sediment yield if it results in sediment delivery to the surface water drainage system of arroyos and streams. Only a fraction of the total amount of soil erosion on the landscape actually reaches surface water channels.

- Operating motorized vehicles on moist soils, especially heavy equipment, is likely to cause compaction of the surface layer, which may increase runoff, decrease infiltration and aeration, and reduce soil productivity by making it more difficult for plant roots to establish or obtain soil moisture and nutrients.

The thresholds for impact analysis and significance include:

- The significance of the effects on soils is related to the areal extent of the impacts and the length of time necessary for the soils to recover following surface disturbance.
- The significance of the direct effects on soils from the surface-disturbing activities (soil displacement, compaction, erosion, loss of productivity) can be assessed in relation to the extent of indirect effects on other resources. For example, if surface-disturbing activities cause erosion that leaves the construction site and enters waterways that already have identified impairment due to high volumes of sediment, turbidity, and excessive stream bottom deposits, a small increase in sediment entering this water system may be considered significant. If removal or compaction of topsoil damages soil-protecting vegetative cover and limits the success of revegetation to stabilize soils, accelerated erosion would result that would reduce feed and cover for wildlife, forage for livestock, and downstream water quality.

4.4.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be authorized by the BLM and would not be developed. Project-related impacts to soils from construction and operation would not occur. Natural and human-caused effects of erosion, agriculture, fire, recreation, oil and gas development, mining, and grazing would continue to affect soil resources at present levels in the project area.

4.4.5 Alternative A—Proposed Action

The Proposed Action would result in approximately 1,022 acres of initial soil disturbance. **Table 4.4-1** provides the acres of disturbance for Alternative A associated with specific limitations as described in Section 3.4.

Surface disturbance associated with construction of project roads, the HB mill, wells, ponds, pipelines, power lines, and other associated facilities would impact soil resources to varying degrees. The most notable disturbance to soils would occur on soils with severe limitations.

Grading and leveling would be required to construct the HB mill, wells, and facilities, with the greatest level of effort required on sloping areas. During construction, the soil profiles would be mixed with a corresponding loss of soil structure. Some of the subsoils in the area are characterized as having high pH, salts, and sodium. Soil mixing could alter physical and chemical properties such as sodium content, alkalinity, organic matter, salinity, rock fragments, high carbonates, and high sand or clay content, which could have negative effect on soil productivity and alter revegetation potential and other reclamation work. Similarly, soil productivity and the potential for successful reclamation would decrease if spills of salt brine or dried salt precipitants were to occur. Topsoil would be stockpiled at well pads, where topsoil is available. Approximately 2 percent of the initial soil disturbance would occur on soils characterized as having poor topsoil suitability. In these areas, suitable topsoil may not be available to stockpile. Approximately 77 percent of the area initially disturbed within the project area would have poor potential for revegetation, requiring aggressive mitigation measures and monitoring to ensure successful reclamation.

Soils would be compacted as a result of the construction of the HB mill, project roads, and associated facilities with compaction maintained, at least in part, by continued vehicle and foot traffic as well as operational activities.

Table 4.4-1 Limitations of Soils Affected by Surface Disturbance under Alternative A

	Good				Fair				Poor				Not Rated			
	Initial Disturbance		Permanent Disturbance		Initial Disturbance		Permanent Disturbance		Initial Disturbance		Permanent Disturbance		Initial Disturbance		Permanent Disturbance	
Soil Limitation	Acres/%		Acres/%		Acres/%		Acres/%		Acres/%		Acres/%		Acres/%		Acres/%	
Wind Erosion	8	1%	4	0%	581	57%	496	48%	216	21%	159	16%	0	0%	0	0%
Water Erosion	840	82%	682	67%	0	0%	0	0%	0	0%	0	0%	42	4%	31	3%
Road Construction	435	42%	372	45%	192	19%	129	16%	178	17%	159	19%	78	8%	54	6%
Shallow Excavations	73	7%	46	6%	214	22%	180	22%	517	53%	433	52%	78	8%	54	6%
Potential for Revegetation	0	0%	0	0%	16	2%	8	1%	792	77%	653	79%	75	7%	52	6%
Topsoil Suitability	210	21%	155	15%	510	50%	452	44%	22	2%	12	1%	141	14%	93	9%

Note: Acres will not equal total amount disturbed because not all minor soil map unit components are characterized in the SSURGO database.

Source: NRCS 2008a.

The potential for erosion would increase through the loss of vegetation and biological crust cover as compared to an undisturbed state. Approximately 21 percent of the initial disturbance would occur on highly wind erodible soils, while long-term disturbance would occur on approximately 16 percent of the soils that are susceptible to wind erosion.

Biological soil crusts are considered an important component in dry arid ecosystems. They provide soil stability, prevent erosion, fix nitrogen, increase infiltration rates, and may reduce noxious weed migration. In arid environments, biological soil crusts are essential for soil stability due to minimal vegetative growth and soil cover. Biological soil crusts are highly susceptible to disturbance, especially in sandy soils (Belnap and Gardner 1993). Recovery rates are generally slow, specifically for lichen and moss recovery, which can take 45 to 250 years, respectively (Belnap and Gillette 1997). Biological crusts would be damaged by vehicle traffic, clearing, grubbing, and excavation. The effect of the proposed construction and operations activities on biological soil crusts would be very long-term.

Pipelines would be constructed on the soil surface and buried at site-specific locations within the project area, such as at road crossings and every quarter mile for wildlife crossings. Steep slopes would be avoided for pipeline construction. Approximately 52 percent of initial disturbance would occur on soils with severe limitations associated with shallow excavations, so trenches must be stabilized if allowed to stand open or if workers must enter a trench.

Construction of roads, ponds, and pipelines would result in a removal of vegetation, interrupting nutrient cycling and altering soil productivity. Indirect effects related to the construction of new access roads may include increased erosion caused by concentrated surface water runoff, and disruption and interception of subsurface flow of water that could alter soil moisture regimes upslope and down slope from the road. Where the topography is relatively flat and grading occurs, disturbance would be limited to the upper subsurface soil horizons. As a result, subsurface soils would not be subject to profile mixing. Where cut and fill slopes occur, the soil profiles would be mixed with a corresponding loss of soil structure. Caliche surfacing would be applied to stabilize the road surface.

Traffic on roads during construction and operations would result in soil compaction. Soil compaction would considerably impact the upper profile subsoils immediately beneath the road surface but also would impact subsurface soils at a greater depth if fine textured soils are present. Soil compaction would result in a corresponding loss of infiltration, permeability, and soil aeration. Runoff and soil erosion would increase as a result of compaction. Erosion also would be minimized through the use of erosion control devices (e.g., silt fences, jute netting, hay bales, water bars, check dams, berms, shallow swales, mulches).

Within Section 2, T21S, R29E, three Xcel overhead power lines with ROWs totaling 3.4 miles, two New Mexico Gas underground gas lines (1.8 miles), and one AT&T fiber optic line (0.6 mile) would require relocation prior to construction of the evaporation ponds. The resulting impacts related to pipeline relocation would include possible soil mixing during trenching and a short-term reduction in soil productivity. Impacts associated with power line relocations would include disturbance to surface soils due to grading of the ROW and compaction due to construction vehicles. There would be a site-specific loss of soil resources at pole locations. Soil mixing could also result during grading activities and adjacent to pole locations if unsuitable subsoils are brought to the surface during auguring.

These impacts would begin immediately as the soils are subjected to grading and other construction activities and would move to a steady state as construction activities are completed and interim reclamation and operations begin. As disturbed areas are reclaimed and vegetation is re-established the potential for erosion and sedimentation would be reduced.

Indirect effects would include a possible reduction in hydric soils found at playas, seeps, and springs due to drawdown associated with the pumping of groundwater from the Rustler Formation. In addition, soils compacted by construction equipment or covered with impermeable materials, such as concrete or

compacted caliche, would have indirect effects related to a decrease in surface water infiltration, an associated increase in surface water runoff, and poor plant growth or seed germination.

4.4.6 Alternative B

Alternative B would result in 1,435 acres of initial impacts to soil resources. Alternative B would result in more surface disturbance to soils than the other alternatives. Impacts associated with this alternative would be similar to Alternative A except the PCA wells and pipelines would not be constructed. Instead either the existing Caprock pipelines would be replaced, or a new Caprock pipeline would be constructed further south of the existing line. Impacts associated with the facilities in the project area as described in Alternative A would be the same for Alternative B. Excavation of the old Caprock pipeline ROWs would disturb previously disturbed soils, while construction of the new line would cause new soil disturbance along the pipeline ROW. All disturbed areas affected by the replacement of the existing Caprock line would be stabilized and revegetated. Although the new Caprock pipeline would be stabilized through revegetation, there would be long-term disturbance affecting 914 acres due to the maintenance of access roads, caliche pits, and ponds.

Table 4.4-2 provides the acres and percentage of soils disturbed under Alternative B associated with the specific limitations described in Section 3.4 for the project area and Caprock pipelines. In areas with poor topsoil suitability, suitable topsoil may not be available to stockpile. Disturbance on soils that have a poor potential for revegetation may require aggressive mitigation measures and monitoring to ensure successful reclamation. Soils with severe limitations associated with shallow excavations would require stabilization of trenches if allowed to stand open or if workers are required to enter a trench.

In general, the direct and indirect impacts to soils described for the Proposed Action also would apply under Alternative B, but on more acreage due to the proposed excavation associated with construction of the proposed or existing Caprock pipelines.

4.4.7 Alternative C

Alternative C would result in 1,022 acres of initial soil disturbance. Impacts associated with Alternative C would be similar to Alternative A except all of the pipelines would be buried. This would require excavation of the soils within the pipeline ROW. Excavation of soils within the pipeline ROW would modify the existing soil structure and infiltration rates. Soil horizons would be mixed during excavation and reapplication, which could lower soil productivity by diluting the physical, biological, and chemical properties of the topsoil with less productive subsoil. Segregation of topsoil helps to mitigate these effects. There would be less long-term bare ground and no surface pipelines associated with Alternative C, but all other aspects of the implementing the project would be the same as the Proposed Action.

4.4.8 Alternative D—Preferred Alternative

The Preferred Alternative would result in 1,331 acres of initial surface disturbance, more soil disturbance than Alternatives A, B, or C. Topsoil would be stockpile, revegetated, and not be disturbed until final reclamation, which would improve reclamation success in the long term. **Table 4.4-3** provides the acres of disturbance for the Preferred Alternative associated with the specific soil limitations described in Section 3.4.

Table 4.4-2 Limitations of Soils Affected by Surface Disturbance under Alternative B

Soil Limitation	Good				Fair				Poor				Not Rated			
	Initial Disturbance		Perm Disturbance		Initial Disturbance		Perm Disturbance		Initial Disturbance		Perm Disturbance		Initial Disturbance		Perm Disturbance	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
With Proposed New Pipeline																
Wind Erosion	8	1%	4	0%	700	49%	534	58%	320	22%	192	21%	2	0%	52	6%
Water Erosion	1,071	75%	754	83%	-	0%	-	0%	-	0%	-	0%	4	0%	1	0%
Road Construction	465	32%	475	52%	206	14%	164	18%	179	12%	199	22%	78	5%	64	7%
Shallow Excavations	80	6%	60	7%	265	18%	242	26%	692	48%	595	65%	78	5%	64	7%
Potential for Revegetation	-	0%	-	0%	19	1%	11	1%	1,021	71%	888	97%	76	5%	62	7%
Topsoil Suitability	249	17%	167	118%	533	37%	459	50%	193	13%	67	7%	140	10%	93	10%
With Existing Caprock Pipeline Option																
Wind Erosion	8	1%	4	0%	589	41%	496	54%	357	25%	159	17%	168	12%	51	6%
Water Erosion	1,179	82%	684	75%	-	0%	-	0%	-	0%	-	0%	-	0%	-	0%
Road Construction	687	48%	467	51%	329	23%	161	18%	194	14%	194	14%	92	6%	63	7%
Shallow Excavations	89	6%	58	6%	292	20%	226	25%	777	54%	542	59%	82	6%	63	7%
Potential for Revegetation	-	0%	-	0%	18	1%	10	1%	1,145	80%	818	90%	79	6%	61	7%
Topsoil Suitability	218	15%	157	17%	559	39%	453	50%	61	4%	12	1%	381	27%	92	10%

Note: Acres will not equal total amount disturbed because not all minor soil map unit components are included in the SSURGO database.

No long-term disturbance is anticipated associated with upgrades to the existing Caprock pipeline, disturbance to soils will be temporary and soils will be stabilized following construction. Source: NRCS 2008a.

Table 4.4-3 Limitations of Soils Affected by Surface Disturbance under Preferred Alternative

	Good				Fair				Poor				Not Rated			
	Initial Disturbance		Perm Disturbance		Initial Disturbance		Perm Disturbance		Initial Disturbance		Perm Disturbance		Initial Disturbance		Perm Disturbance	
Soil Limitation	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Wind Erosion	0	0%	0	0%	581	44%	505	53%	284	21%	207	22%	0	0%	0	0%
Water Erosion	912	69%	738	77%	0	0%	0	0%	0	0%	0	0%	42	3%	29	3%
Road Construction	472	49%	400	30%	226	23%	154	12%	177	18%	161	12%	80	8%	52	4%
Shallow Excavations	84	9%	49	4%	220	23%	185	14%	570	59%	481	36%	80	8%	52	4%
Potential for Revegetation	0	0%	0	0%	16	2%	8	1%	862	90%	709	53%	77	8%	51	4%
Topsoil Suitability	272	20%	201	21%	507	38%	459	48%	29	2%	14	1%	147	11%	93	10%

Note: Acres will not equal total amount disturbed because not all minor soil map unit components are characterized in the SSURGO database.

Source: NRCS 2008a.

4.4.9 Mitigation Measures

Recommended additional mitigation measures include the following:

- During reclamation, compacted areas (typically any area that received repeated traffic or three or more passes by heavy equipment) should be subsoiled or ripped to the depth of compaction. This will help prepare the seed bed, encourage surface water infiltration, and help to prevent accelerated runoff and erosion.
- For those soils that are difficult to revegetate, structural erosion control measures should be employed. Regular monitoring of revegetated and reclaimed areas should be implemented, with regular maintenance or reseeding as needed.

Long-term topsoil stockpiles would be monitored after large precipitation events and quarterly for erosion. If erosion is noted, additional erosion control measures would be implemented to control and prevent loss of topsoil.

4.4.10 Summary of Impacts

Alterations of soils due to construction activities would be similar under all alternatives, with more acreage affected under Alternative B due to the proposed excavation of the Caprock pipelines outside the project area. Due to the clearing, grubbing, and earthmoving under all alternatives except No Action, there would be long-term impacts on soil productivity resulting from implementation of the proposed project. Stabilization of soils through revegetation of disturbed areas once construction activities are completed would take a long time to be successful due to the disruption of soil biological crusts and the high percentage of soils that are susceptible to erosion and those that have poor potential for revegetation. Monitoring and maintenance of erosion and sediment control measures and reclaimed areas would be important to ensure the successful stabilization of disturbed soils.

Implementation would result in residual impacts associated with the long-term loss of soil productivity on approximately 829 acres in the project area under the Proposed Action and Alternative C, 914 acres under Alternative B, and 962 under Alternative D. These long-term impacts are associated with the caliche surfaced roads, areas covered with aboveground structures or buildings, areas converted to ponds, caliche pits, and soils covered by pipelines. As facilities are decommissioned and portions of the project area are reclaimed these impacts would be reduced after project completion.

4.5 Air Quality

4.5.1 Issues

The primary issues related to air quality include potential air quality impacts associated with project-generated air emissions.

4.5.2 Method of Analysis

Impact analysis for air quality was performed using primarily qualitative methods by reviewing the existing air quality permits that Intrepid holds for its West, East, and North plants and assuming that similar emissions would result from the new HB mill processing facility. Preliminary data that will be submitted to NMED-AQB for an air quality permit for the new HB mill by Intrepid was used to predict the new emissions that would be generated under the action alternatives. Mobile and stationary source emissions were calculated based on established factors from AP-42 (USEPA 1995) applied to Intrepid's projections of equipment to be used for construction and operations. No modeling was completed specifically for this EIS, but the following modeling supplied by Intrepid was used to evaluate project impacts and compare to state and federal standards.

- Air dispersion modeling (FC&E Engineering 2010) that was conducted using one year of meteorological data and using the USEPA-approved AERMOD model was used to evaluate project impacts from the proposed HB mill and compare against the NAAQS and NMAAQS.
- The same air dispersion modeling was used to evaluate project impacts from the proposed HB mill and compare against modeling significance levels at the Living Desert State Park.

4.5.3 Assumptions

The assumptions used to arrive at the conclusions as part of the air quality analysis include the following:

- It is assumed that if the project were to cause or significantly contribute to an exceedence of the NAAQS or NMAAQS, this would be considered a significant impact.
- If the project were to cause a Federal Class I area or New Mexico sensitive Class II area to be adversely affected, this would be considered a significant impact if no mitigation were utilized.
- The air pollutant emission rates for the proposed HB mill based upon preliminary engineering design information, as provided by Intrepid, are assumed to accurately reflect current plans for the proposed project.

Environmental impacts to air resources would be significant if the Proposed Action or other action alternatives result in any of the following:

- Exceedence of National or State AAQS
- Exposure of sensitive receptors to substantial toxic air pollutant concentrations

4.5.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the associated air quality impacts would not occur. Under this alternative, the existing Intrepid potash mining would continue to operate under current authorizations.

4.5.5 Alternative A—Proposed Action

The Proposed Action would include new emissions sources from the proposed new HB mill and associated support facilities. Existing emissions sources at the three Intrepid Potash mines include existing permitted sources (stationary sources) and mobile sources. During construction, additional sources mostly consisting of mobile and non road engines would be involved in construction of de-watering pits and other facilities. These vehicles would have combustion emissions as well as fugitive dust emissions while traveling on paved and unpaved roads. A brief summary of the emissions from these sources is shown in the following tables.

Table 4.5-1 lists the maximum amounts that Intrepid Potash may emit from existing sources, based on existing NMED-AQB permits. Permitted sources include the new HB Mill, the East Compaction Unit, the MPI North Plant, and the West Flotation Plant. The emissions shown in the table reflect the permitted potential to emit.

Mobile source fuel usage estimates for the existing operations, the proposed HB In-Situ Solution Mine Project, and temporary sources projected to be active during the construction of the new facilities are shown in **Table 4.5-2**.

It should be noted that the emissions for construction equipment are conservative but are fairly rough estimates, and should not be considered a comprehensive emissions inventory because the exact types and models of each piece of equipment, the anticipated number of hours of operation, the estimated vehicle miles traveled or equivalent parameters are uncertain at this time. The emissions calculations are

based on projected fuel consumption figures provided by Intrepid and the emission factors found in USEPA AP-42 (USEPA 1995), representing a reliable but conservative estimate of actual emissions.

Table 4.5-1 Intrepid Potash Existing Stationary Sources (Permitted Potential to Emit)

Intrepid Potash Permits	Pollutant Emissions (tpy)				
	TSP	PM_{10}	NO_X	CO	VOC
East Compaction Unit	292.4	292.4	195.1	206.6	10.7
MPI North Plant and West Flotation Plant	188.4	188.5	128.0	144.2	2.5
HB Plant	91.2	31.0	15.1	12.7	.8
Facility Totals	**572.0**	**511.9**	**338.2**	**363.5**	**14.0**

Source: NMED 2006,1999a,b, 2011.

Table 4.5-2 Estimated Fuel Usage from Intrepid's Non-Stationary Mine Sources, Existing and Proposed

Location	Diesel Use Range (gallons)		Gasoline Use Range (gallons)	
	Low	High	Low	High
Existing Operations	280,000	385,000	57,600	75,600
Proposed HB In-Situ Project	109,600	150,700	21,600	28,350
Total Operating Fuel Use	*389,600*	*535,700*	*79,200*	*103,950*
Estimated Fuel Use during Construction of Proposed HB In-Situ Project	2,017,933	2,017,933	68,079	68,079
Total Fuel Use	**2,407,533**	**2,553,633**	**147,249**	**172,029**

Source: Intrepid Potash, Inc. 2010a.

Total existing and proposed project mobile source pollutant emissions estimates from engines during construction and operation are shown in **Tables 4.5-3**, **4.5-4**, and **4.5-5**.

Table 4.5-3 Total Estimated Mobile Source Emissions from Existing Operations Based on Fuel Usage

Fuel Type	Construction and Operation Emissions (tpy)				
	NO_X	CO	VOC	SO_2	PM_{10} / $PM_{2.5}$
Diesel	116.30	25.05	9.49	7.65	8.18
Gasoline	8.01	4.86	14.89	0.41	0.49
Totals	**124.31**	**29.92**	**24.38**	**8.06**	**8.67**

Source: USEPA AP-42 emission factors (USEPA 1995) for diesel and small gasoline engines applied to the gross fuel consumption totals shown in **Table 4.5-2**.

Table 4.5-4 Total Estimated Mobile Source Emissions from Proposed HB In-Situ Project Operations Based on Fuel Usage

Fuel Type	Operations Emissions (tpy)				
	NO_X	CO	VOC	SO_2	PM_{10} / $PM_{2.5}$
Diesel	45.52	9.81	3.72	2.99	3.20
Gasoline	3.00	1.82	5.58	0.15	0.18
Totals	**48.53**	**11.63**	**9.30**	**3.15**	**3.38**

Source: USEPA AP-42 emission factors (USEPA 1995) for diesel and small gasoline engines applied to the gross fuel consumption totals shown in **Table 4.5-2**.

Table 4.5-5 Total Estimated Mobile Source Emissions during Construction of Proposed HB Project Based on Fuel Usage

Fuel Type	Construction Emissions (tpy)				
	NO_X	CO	VOC	SO_2	PM_{10} / $PM_{2.5}$
Diesel	609.59	131.32	49.76	40.09	42.85
Gasoline	7.21	4.38	13.41	0.37	0.44
Totals	**616.80**	**135.70**	**63.17**	**40.46**	**43.29**

Source: USEPA AP-42 emission factors (USEPA 1995) for diesel and small gasoline engines applied to the gross fuel consumption totals shown in **Table 4.5-2**.

4.5.5.1 Proposed New or Modified Stationary Sources

The proposed new HB mill and associated facilities would be new emission sources. This section lists the emissions sources and regulated air pollutants that may be expected to be generated from the proposed HB In-Situ Solution Mine Project facilities.

Based on the air emissions inventory, the total potential to emit from the proposed HB In-Situ Solution Mine Project would be less than the major source threshold of the Federal Operating Permit Programs under the CAA (40 CFR 70 Title V), which is 100 tpy for any regulated criteria air pollutant, less than 10 tpy of any regulated individual HAP, and less than 25 tpy of all regulated HAPs combined. Consequently, the proposed facility would not be subject to Title V major source permitting requirements and the construction of the facilities would not be subject to PSD regulations.

The projected emissions sources at the proposed new HB mill are briefly described in **Table 4.5-6** to illustrate the potential air emissions. Stationary sources are those that have a stack, baghouse, or other single emissions point. Fugitive emissions sources are those sources that could not reasonably pass through a stack, chimney, or vent and include paved and unpaved roads, conveyors, or other similar activities that do not have a single point of emission. **Table 4.5-7** lists the projected emissions from stationary and fugitive sources at the proposed new HB mill.

Emission factors were derived from AP-42 (USEPA 1995) for the combustion sources fired with natural gas, including the fluidized bed dryer, the boiler, and the amine heaters. A fuel Btu value of 1,050 Btu/standard cubic feet (scf) was used in the estimates for emissions.

Table 4.5-6 Emissions Sources Projected from the Proposed New HB Mill

Emissions Source	Description	Source Type
EP-01 Dryer Scrubber Stack	Natural gas fired fluidized bed dryer with unvented cyclone and wet venturi scrubber (16 MMBtu/hr)	Stationary
EP-02 Boiler Stack	Natural gas fired steam boiler (0.67 MMBtu/hr)	Stationary
EP-03a Amine Heater Stack	Natural gas fired amine heater #1 (6.0 MMBtu/hr)	Stationary
EP-03b Amine Heater Stack	Natural gas fired amine heater #2 (6.0 MMBtu/hr)	Stationary
EP-04a Truck Load Out	Truck loadout bin #1 equipped with baghouse	Stationary
EP-04b Truck Load Out	Truck loadout bin #2 equipped with baghouse	Stationary
EP-05 Cooling Tower	Cooling Tower	Stationary
Paved and Unpaved Roads	Haul roads associated with hauling raw materials,	Fugitive
Conveyors and Weigh Belts	Bucket elevators, belts and conveyors used to transport intermediate or final products	Fugitive
Storage Tanks	Additive and chemical storage tanks	Fugitive

Source: Intrepid Potash, Inc. 2010b.

Table 4.5-7 New Stationary Emissions Projected from the Proposed New HB Mill

	Emission Points and Annual Emissions					
Pollutant	**Fluidized Bed Dryer (tpy)**	**Boiler (tpy)**	**Two Amine Heaters (tpy)**	**Cooling Tower (tpy)**	**Truck Load-outs (tpy)**	**Facility-wide Stationary Totals (tpy)**
TSP	5.26	0.02	0.38	0.27	5.85	11.78
PM_{10}	5.26	0.02	0.38	0.27	5.85	11.78
$PM_{2.5}$	2.63	0.01	0.19	0.27	2.93	6.03
NO_X	6.67	0.28	5.01	n/a	n/a	11.96
CO	5.61	0.23	4.20	n/a	n/a	10.04
SO_2	0.04	0.002	0.03	n/a	n/a	0.07
VOC	0.37	0.02	0.28	n/a	n/a	0.67
HAPs	0.1260	0.0053	0.0473	n/a	n/a	0.18

n/a – not applicable.

Source: Intrepid Potash, Inc. 2010b.

Because ozone generation is a function of chemical reactions between NO_X and VOCs in the presence of ultraviolet radiation, potential ozone impacts can be evaluated based upon the emissions of NO_X and VOCs from the HB In-Situ Solution Mine Project. As noted in **Table 4.5-7**, NO_X emissions from the proposed new HB mill amount to 11.96 tpy, and VOC emissions from the proposed new HB mill amount to 0.67 tpy. As shown in **Table 3.5-4**, the total NO_X and VOC emissions from the primary stationary sources in Eddy County based upon 2002 emissions data are 2,677 tpy for NO_X and 1,175 tpy for VOCs.

As the projected NO_X emissions from the HB In-Situ Solution Mine Project would be less than 1 percent of the Eddy County emissions and the projected VOC emissions would be less than one tenth of 1 percent of the Eddy County emissions, it can be presumed that project emissions would result in a negligible contribution to the regional ozone ambient concentrations.

4.5.5.2 Fugitive Sources

Atmospheric dust arises from the mechanical disturbance of granular material exposed to the air. Dust generated from these open sources is termed “fugitive” because it is not discharged to the atmosphere in a confined flow stream. Common sources of fugitive dust include paved and unpaved roads, agricultural tilling operations, aggregate storage piles, and heavy construction operations (USEPA 1995). Fugitive sources in the HB In-Situ Solution Mine project area include paved roads, unpaved roads, conveyors, and tanks.

Fugitive dust is caused by two basic physical phenomena:

1. Pulverization and abrasion of surface materials by application of mechanical force through implements (wheels, blades, etc.).
2. Entrainment of dust particles by the action of turbulent air currents, such as wind erosion of an exposed surface by wind speeds over 19 km per hour (12 miles per hour [mph]).

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and re-suspension of loose material on the road surface. In general terms, re-suspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas (USEPA 1995).

When a vehicle travels an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. Other variables are important in addition to the silt content of the road surface material. For example, at industrial sites, where haul trucks and other heavy equipment are common, emissions are highly correlated with vehicle weight. On the other hand, there is far less variability in the weights of cars and pickup trucks that commonly travel publicly accessible unpaved roads throughout the U.S. For those roads, the moisture content of the road surface material may be more dominant in determining differences in emission levels between, for example a hot, desert environment and a cool, moist location (USEPA 1995).

Processes that have the potential to generate fugitive emissions at the proposed facility include:

- Harvest of precipitated potash and salt at the solar evaporation ponds and transport to a new flotation mill (new HB mill).
- Refinement of ore to marketable product at the new HB mill and the existing Intrepid North Plant.
- Recycling of NaCl tailings to condition the injection source groundwater.

The conveyors represent a potential fugitive emissions source; the proposed conveyors would be enclosed, thereby reducing the actual emissions. The storage tanks are considered an insignificant source of fugitive emissions. Fugitive emissions from each of the source types at the proposed HB mill and facilities to support solution mining operations including conveyors, paved and unpaved roads, and storage tanks are summarized in **Table 4.5-8**.

Table 4.5-8 Summary of Fugitive Emissions

Pollutant	Conveyors (tpy)	Paved Roadways (tpy)	Unpaved Roadways (tpy)	Storage Tanks (tpy)	Facility-wide Fugitive Totals (tpy)
TSP	Neg.	16.20	63.10	n/a	79.30
PM_{10}	Neg.	3.15	16.08	n/a	19.23
$PM_{2.5}$	Neg.	0.47	1.61	n/a	2.08
NO_X	n/a	n/a	n/a	n/a	n/a
CO	n/a	n/a	n/a	n/a	n/a
SO_2	n/a	n/a	n/a	n/a	n/a
VOC	n/a	n/a	n/a	<0.01	<0.01
HAPs	n/a	n/a	n/a	<0.01	<0.01

n/a: not applicable. Neg: Negligible

Source: Intrepid 2010b.

4.5.5.3 Ambient Air Quality Modeling

The purpose of the air dispersion modeling conducted for the proposed HB In-Situ Solution Mine project was to evaluate whether ambient air quality impacts beyond the property “fenceline” would be significant as a result of the construction and operation of the new HB mill and associated facilities. The ambient air quality modeling was performed in accordance with the NMED-AQB Dispersion Modeling Guidelines (NMED-ABQ 2010b), and addressed all regulated air pollutants that may be greater than the modeling thresholds specified in the modeling guidelines.

An ambient air quality modeling study was also conducted to demonstrate potential impacts on the Living Desert State Park (FC&E Engineering 2010), which is identified in the NMED air dispersion modeling guidelines as a sensitive Class II area. Modeling was conducted using the maximum hourly emission rate for comparison to short-term standards and annual average emission rates were used for comparison to annual standards. The latest version of AERMOD (09292) was used to determine the ambient air quality impacts due to the proposed project. The model was executed using the regulatory default option for the TSP analysis. Subsequent PM_{10} and $PM_{2.5}$ analyses were conducted using the non-default FASTALL option.

4.5.5.4 Air Quality Modeling Results

A NAAQS Analysis was conducted for TSP, PM_{10}, $PM_{2.5}$, and NO_2 but not for CO. The results of the NAAQS modeling are presented in **Table 4.5-9** along with background values and national and state ambient standards. According to New Mexico modeling guidelines, background concentrations for NO_X, CO, and SO_2 do not apply unless the source is located near Bernalillo County or El Paso. As the proposed project is not located near these areas, only the modeled concentrations are compared to the ambient air quality standards to determine compliance. Background concentrations for TSP, PM_{10}, and

$PM_{2.5}$ are added to the modeled concentrations to determine compliance. NO_2 results have been adjusted using the Ambient Ratio Method of 0.75 prior to comparison to the ambient standards.

Table 4.5-9 Summary of NAAQS Modeling Results, New HB Mill

Pollutant	Averaging Period	Modeled Results ($\mu g/m^3$)	Background ($\mu g/m^3$)	Modeled Results with Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	NMAAQS
NO_2	Annual	2.4	—	2.4	100	0.050 ppm
	24-hour	10.8	—	10.8	—	0.10 ppm
$PM_{2.5}$	Annual	1.73233	7.3	9.0	15	—
	24-hour	8.39213	7.3	15.6	35	—
PM_{10}	Annual	5.15941	20.0	25.1	—	—
	24-hour	17.60951	20.0	37.6	150	—
TSP	Annual	18.23126	26.6	44.8	—	60 $\mu g/m^3$
	24-hour	58.66950	26.6	85.3	—	150 $\mu g/m^3$

Source: FC&E Engineering 2010.

The maximum predicted impacts for the CO 1-hour and 8-hour averaging period were below the modeling significant impact levels; therefore, CO modeling was not required.

Emissions of NO_2, SO_2, and PM_{10} from the proposed project would consume increment because the minor source baseline date for these pollutants has been set. The results of the NO_2 and PM_{10} PSD increment analysis are presented in **Table 4.5-10**. PSD increment modeling was not required for SO_2.

Table 4.5-10 Summary of PSD Increment Modeling Results, New HB Mill

Pollutant	Averaging Period	Modeled Results ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)
PM_{10}	Annual	5.02346	17
	24-hour	17.55345	30
NO_2	Annual	2.8	25

Source: FC&E Engineering 2010.

The highest-first-high short-term modeled impact and the highest annual average modeled impact were compared to the Class II PSD increments and the facility was found to be in compliance; therefore, no additional analyses were required.

As shown in **Table 4.5-9** and **4.5-10**, a comparison of the project's maximum impacts for criteria pollutants (including background values) to the applicable AAQS indicates that there is no threat to an ambient air quality standard or PSD increment based on air dispersion modeling.

The air dispersion modeling that was conducted for Intrepid to determine potential impacts of the proposed project to the Living Desert State Park show that modeled results are well below both Class I and Class II modeling significance levels. The highest-first-high short-term and highest annual average modeled values are presented in **Table 4.5-11** along with background values and significance levels.

Table 4.5-11 Summary of Modeled Results, Living Desert State Park

Pollutant	Averaging Period	Modeled Results ($\mu g/m^3$)	Class II Modeling Significance Levels ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	NMAAQS
CO	8-hour	0.10793	500	10,000	8.7 ppm
	1-hour	0.74956	2,000	40,000	13.1 ppm
NO_2	Annual	0.00094	1.0	100	0.050 ppm
	24-hour	0.04293	5.0	—	0.10 ppm
	1-hour	1.02362	5.0	188	—
$PM_{2.5}$	Annual	0.00091	0.3	15	—
	24-hour	0.03382	1.2	35	—
PM_{10}	Annual	0.00298	1.0	—	—
	24-hour	0.05936	5.0	150	—
TSP	Annual	0.00935	1.0	—	60 $\mu g/m^3$
	24-hour	0.23073	5.0	—	150 $\mu g/m^3$

Source: FC&E Engineering 2010.

4.5.5.5 Class I Area Analysis

Experience with the Federal Land Managers' Air Quality Related Values Work Group (FLAG) 2000 recommendations in dealing with many new source review applications led the federal agencies involved to believe that an initial screen to exempt a source from AQRV impact review based on its annual emissions and distance from a Class I area may be appropriate in most situations. In October 2010, the FLMs issued proposed new guidance regarding assessment of newly proposed air emission sources on AQRVs in Class I areas. The 2010 FLAG guidance provides a method to screen out from AQRV review proposed emission sources with relatively low emissions at large distances from Class I areas. This method is referred to as the Q/D screening criteria, where Q is the sum of the short-term emission rates of SO_2, NO_X, PM_{10}, and H_2SO_4 expressed in tpy, and D is the distance from the Class I area in kilometers. A value of ≤10 would be considered to have a negligible impact on the Class I area and FLM consultation should not be required (FLAG 2010).

Based upon the 2008 FLAG Q/D methodology, emissions of SO_2+NO_X+PM_{10}+H_2SO_4 in tpy from the proposed HB In-Situ Solution Mine Project (0.07+11.96+31.02+Neg) divided by the distance to the nearest Class I area, Carlsbad Caverns National Park, in kilometers (52 km) results in a value of 0.828. This value is well below the screening value of ≤10 proposed by the FLAG, thus meeting the presumptive no adverse impact test for this screening analysis.

4.5.6 Alternative B

Under this alternative, excavation to replace existing Caprock pipelines or installation of a new Caprock line would be performed, which would result in approximately 400 acres or 279 acres, respectively, initial

surface disturbance in addition to that described for the Proposed Action. All other project facilities would be essentially the same as described under the Proposed Action. Potential air quality impacts under this alternative would be slightly higher than the impacts from the Proposed Action because the additional surface disturbance would cause temporarily increased particulate matter to be released into the atmosphere along with additional combustion emissions from the construction equipment that would be used for the pipeline excavation. These impacts to air quality would be minor and temporary. All other impacts would be the same as those described under the Proposed Action.

4.5.7 Alternative C

Under this alternative, all pipelines would be buried within the pipeline ROW rather than having some pipelines located on the surface. As the total acreage of surface disturbance would be the same as that described for the Proposed Action, air quality impacts from this alternative would generally be the same. However, as more excavation would be required for the burial of the pipeline, there would be additional construction emissions from equipment for a longer period of time, resulting in slightly higher short-term air quality impacts. All other impacts would be the same as those described under the Proposed Action.

4.5.8 Alternative D—Preferred Alternative

Under this alternative, impacts would be similar to Alternative B, but with additional construction emissions as more excavation would be required for the selective burial of the pipeline, similar to Alternative C.

4.5.9 Mitigation Measures

Recommended additional mitigation measures include development of a dust control plan prior to the start of construction activities. The dust control plan would provide for methods of dust suppression such as water application to haul roads and other disturbed areas or chemical dust suppressant application where appropriate, according to accepted and reasonable industry practice. The BLM will encourage the use of equipment that meets EPA's Highway Diesel and Nonroad Diesel Rules for project construction and maintenance operations.

4.5.10 Summary of Impacts

No significant adverse impacts to air quality would occur under any alternative because state and federal air quality standards would not be exceeded.

No long-term residual impacts to air quality from implementation of the proposed project would occur because reclamation and revegetation would stabilize exposed soil and control fugitive dust emissions. As vegetation becomes established following reclamation, particulate matter emission levels should return to what is typical for an arid environment.

4.6 Climate Change

4.6.1 Issues

Recent scientific evidence suggests there is a direct correlation between climate change and emissions of GHGs. Although many GHGs occur naturally in the atmosphere, human-caused sources have substantially increased the emissions of GHGs since the Industrial Revolution. The primary issues related in climate change include the potential contribution of GHGs by the project.

4.6.2 Assumptions and Method of Analysis

While global and national GHG inventories are being established, regional and state-specific inventories are in varying levels of development. Techniques for quantification of GHG emissions also are in the development stages. There is a relatively good understanding of GHG emissions related to fuel usage

Analytical tools necessary to quantify climatic impacts at the local level are presently unavailable. As a consequence, impact assessment of specific effects of human activities can only be evaluated qualitatively.

USEPA emission factors and estimated fuel usage from Intrepid's non-stationary mine sources were used to evaluate project impacts that may affect climate change.

4.6.3 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the associated climate change impacts would not occur. Under this alternative, the Intrepid's existing potash mines and processing facilities would continue to operate under current authorizations. GHG emissions from existing operations are identified in **Tables 4.6-1** and **4.6-2**.

4.6.4 Alternative A—Proposed Action

Table 4.6-1 provides the calculated GHG (carbon dioxide equivalent [CO_2e]) emissions from electricity used by Intrepid and provided by others. Non-road and mobile sources at Intrepid's operations contribute to the generation of CO_2 emissions. These are calculated from estimated fuel consumption provided by Intrepid, shown in **Table 4.6-2**. Secondary sources of GHG include electricity generated offsite and used to provide electrical service to the mine. Intrepid's estimated annual electrical usage is given in **Table 4.6-3**.

Table 4.6-1 Intrepid's Estimated Annual CO_2e Emissions from Electrical Power Generated by Others

Location	Emissions from Electrical Usage GHG CO_2 (metric tons) Emission factor: 7.18 x 10^{-4} metric tons CO_2e / kWh	
	Low	**High**
Existing Operations	91,186	105,546
Proposed HB Project	23,263	28,433
Total	**114,449**	**133,979**

Source: USEPA GHG emission factor of 7.18 x 10^{-4} metric tons CO_2 / kWh applied to estimates of electrical usage from Intrepid Potash (Table 4-8) (USEPA 2005).

Table 4.6-2 Intrepid's Non-stationary Mine Sources Estimated GHG CO_2e Emissions

Location	Diesel GHG CO_2 (metric tons) (EF: 10.1 kg/gal CO_2)		Gasoline GHG CO_2 (metric tons) (EF: 8.89 kg/gal CO_2)	
	Low	**High**	**Low**	**High**
Existing Operations	2,828	3,889	512	672
Proposed HB Project	1,107	1,522	192	252
Total	**3,935**	**5,411**	**704**	**924**

Source: USEPA GHG emission factors of 10.1 kg CO_2 per gallon for diesel and 8.89 kg CO_2 per gallon for gasoline applied to estimated fuel usage from Intrepid Potash.

Table 4.6-3 Intrepid's Estimated Annual Electrical Usage

Location	Electrical Usage Range (kilowatt hour [kWh])	
	Low	High
Existing Operations	127,000,000	147,000,000
Proposed HB Project	32,400,000	39,600,000
Total	**159,400,000**	**186,600,000**

Source: Intrepid Potash, Inc. 2010a.

There would be temporary power sources associated with construction for the development of new facilities in the HB In-Situ Solution Mine project area. GHG CO_2e emissions for these temporary sources are calculated from anticipated fuel usage and are shown in **Table 4.6-4**. Emission factors for GHG emissions are derived from USEPA (2005), as follows:

- Diesel—10.1 kilograms per gallon (kg/gal) of fuel
- Gasoline—8.89 kg/gal of fuel

Table 4.6-4 Estimated GHG CO_2e Emissions from Construction Sources for the HB In-Situ Solution Mine Project

	Diesel GHG CO_2 (metric tons)	Gasoline GHG CO_2 (metric tons)
Construction Sources	20,381	605

Source: USEPA GHG emission factors of 10.1 kg CO_2 per gallon for diesel and 8.89 kg CO_2 per gallon for gasoline applied to estimated fuel usage from Intrepid Potash.

4.6.5 Alternative B

Under this alternative, increased excavation to replace existing Caprock pipelines or installation of the new Caprock pipe will be required. All other project facilities would be the similar to those described for the Proposed Action. Potential climate change impacts under this alternative would be relatively the same as the impacts from the Proposed Action, as the additional combustion emissions from the construction equipment that would be used for the pipeline excavation would be negligible on a global scale.

4.6.6 Alternative C

Under this alternative, all pipelines would be buried within the pipeline ROW rather than having some pipelines located on the surface. The additional GHG emissions from the construction equipment that would be required for the excavation due to the burial of the pipelines would be negligible on a global scale.

4.6.7 Alternative D—Preferred Alternative

Under this alternative, impacts would be similar to Alternative B. The additional GHG emissions from construction equipment required for pipeline burial would be negligible on a global scale, similar to Alternative C.

4.6.8 Mitigation Measures

Climate change mitigation measures include the implementation of process and energy efficiency programs. As it is in the best interest of Intrepid to conduct operations in as an efficient manner as possible for fuel conservation purposes, process and energy efficiency methods should be incorporated into operational practices.

4.6.9 Summary of Impacts

Impacts to greenhouse gas emissions would be similar across all of the action alternatives. No significant residual impacts to global climate change from the proposed project would occur.

4.7 Vegetation

4.7.1 Issues

The primary issues associated with vegetation resources include:

- Damage to vegetative cover and diversity, surface water flow, groundwater withdrawal, special status plant species, and forage in rangeland areas.
- The introduction or spread of noxious weeds and invasive plants.
- The loss of vegetative cover due to trampling, soil compaction, the direct removal of vegetation and changes in surface water flow resulting from surface-disturbing activities, construction and production activities, aboveground facilities, and subsidence.

4.7.2 Method of Analysis

Potential impacts to vegetation resources were determined based on the locations of these resources in relation to the proposed surface disturbance areas. Using GIS, the locations of proposed surface disturbances, potential subsidence areas, and areas where groundwater drawdown is projected to occur within 40 feet of the surface were overlaid on the vegetation layer to determine the amount of acreage lost for each vegetation type. To determine if known populations or individuals of special status species would be impacted, the locations of proposed surface disturbances and potential subsidence areas were overlaid on available special status plant species GIS layers to determine if known populations or individuals would be affected. Where appropriate and reasonable, suitable habitat was identified for each species and overlaid with the surface disturbance and potential subsidence areas to determine the amount of suitable habitat that would be lost due to the proposed project. Applicant committed measures, and BLM regulations were assumed to be implemented in determining significant impacts.

4.7.3 Assumptions

The following assumptions were used in the analysis of impacts to vegetation resources:

- Areas of recently disturbed bare ground would be more susceptible to erosion and invasion by non-native species.
- Erosion from disturbed areas would be minimal once vegetation or other surface stabilization is established. Successful establishment of herbaceous vegetation generally takes a minimum of 3 to 5 years, depending on soil and precipitation, and requires monitoring until the BLM determines the reclamation to be successful.
- Extensive networks of roads and utility corridors can lead to fragmentation of native landscapes, which can decrease species diversity, lead to decrease in the number and populations of native and special status species, and provide corridors for invasion of non-native species.

- Areas with rehabilitation constraints (e.g., highly erodible or droughty soils, low precipitation amounts, etc.) can have little to no reclamation success, unless additional mitigation measures are implemented.
- Surface disturbance activities result in the conversion of shrub and tree-dominated vegetation cover types to grass/forb-dominated vegetation in the short term.
- Groundwater withdrawals may result in the conversion of riparian vegetation cover types to upland-dominated vegetation.
- Vegetation types most affected by groundwater drawdown are located in areas where the current groundwater level is 40 feet or less from the ground surface. It is assumed that the roots of woody vegetation may extend as deep as 40 feet for moisture.

The thresholds for significant impacts to vegetation are dependent on the extent of surface impacts and the length of time necessary for the native vegetative communities to recover following surface disturbance. Impacts to vegetation resources would be significant if the Proposed Action or alternatives result in one or more of the following:

- New noxious weed species are introduced into the project area, or existing species spread into areas that were previously dominated by native species.
- Loss of special status plant populations, individuals, or conditions that would reduce the ability of the species to maintain its current population status.

4.7.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be approved. Current land use and surface-disturbing activities would continue as currently authorized. No additional surface disturbance or effects on groundwater withdrawal related to potash mining beyond those currently authorized would occur in the project area.

4.7.5 Alternative A—Proposed Action

4.7.5.1 General Vegetation

Under the Proposed Action, 1,022 acres would be removed or impacted due to surface disturbance activities associated with construction and operation of the in-situ mining project. Surface disturbance activities include construction and permanent footprint of groundwater pumping wells, injection and extraction well networks, surface piping system, evaporation ponds, and a new flotation mill. The majority of the disturbance would occur in the Mesquite Upland Scrub and Desert Scrub vegetation cover types. Less than 10 acres of disturbance would affect the riparian, woody riparian and water cover types, while less than 1 acre of disturbance would occur in the Dune and Sand Flat Scrub. **Table 4.7-1** identifies estimated acreage of project-related disturbance by vegetation cover type within the project area. Vegetation cover types in the project area can be found in **Figure 3.7-1**. In addition, vegetation along existing access roads would be affected (e.g., reduction in growth rate) as a result of dust deposition.

Table 4.7-1 Acreage of Affected Vegetation under the Proposed Action Alternative

Vegetation Cover Type	Acres of Temporary Impacts	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
Desert Scrub	346	<1	276	<1
Dune and Sand Flat Scrub	<1	<1	<1	<1
Grassland	44	<1	35	<1

Table 4.7-1 Acreage of Affected Vegetation under the Proposed Action Alternative

Vegetation Cover Type	Acres of Temporary Impacts	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
Mesquite Upland Scrub	597	2	488	1
Riparian	<1	<1	<1	<1
Sandhill Shrubland	28	<1	25	<1
Water[1]	2	<1	1	<1
Woody Riparian	5	<1	3	<1
Total	**1,022**	**3**	**829**	**2**

[1] Includes water land cover type where ROWs overlap. Actual waterbodies would be avoided.

Short-term impacts from project-related activities would include the trampling of herbaceous vegetation, clearing/blading of surface cover, and removal of vegetation for construction. Long-term impacts would include the permanent loss of vegetation for permanent facilities during the life of the project, and the conversion of shrub-dominated cover types to grass/forb-dominated vegetation due to surface clearing activities and changes in soil chemistry from operational activities or if spills of salt brine or salt precipitants were to occur. Vegetative communities also could be affected by damage to biological soil crusts.

Impacts to vegetation could result from groundwater withdrawals for operational activities. Decreases in groundwater depth in areas where the groundwater is currently close to the surface could result in changes in vegetation community composition and structure. Drawdown would decrease root zone soil moisture in areas where the existing groundwater levels are within 40 feet of the surface. In the project area, the groundwater is within this range in the north and central areas, centered around Clayton Lake (see **Figure 3.3-8**). The groundwater drawdown also would potentially affect areas of vegetation outside the project area that are located where the groundwater water is currently within 40 feet of the surface.

In and near the project area, maximum groundwater drawdown is projected to vary from 100 to 200 feet below current groundwater levels over the lifetime of the project. Maximum pumping would occur during the first seven years of the project, and then decrease. Because the aquifer would most likely remain at lowered groundwater levels for an extended period of time (due to slow recharge), changes in plant communities would be long-term. See **Table 4.7-2** to view the vegetation types that would potentially be affected by groundwater drawdown resulting from pumping the Rustler Formation (preferred model and enhanced model).

Table 4.7-2 Acreage of Vegetation Community Types Potentially Affected by Groundwater Drawdown, Proposed Action

Vegetation Type	Acres Affected by Drawdown (where groundwater is currently within 40 feet of surface)	
	Preferred Model	Enhanced Model
Desert Scrub	2,561	2,622
Grassland	836	840
Mesquite Upland Scrub	5,932	6,044
Riparian	123	135

Table 4.7-2 Acreage of Vegetation Community Types Potentially Affected by Groundwater Drawdown, Proposed Action

Vegetation Type	Acres Affected by Drawdown (where groundwater is currently within 40 feet of surface)	
	Preferred Model	Enhanced Model
Sandhill Shrubland	5	6
Water	1,004	1,095
Woody Riparian	639	655

Vegetative community types that would be the most affected by groundwater pumping would be the ones where the groundwater is the closest to the surface (0 to 10 feet). The acres of vegetation that are located where the groundwater is currently 10 feet or less from the surface are shown in **Table 4.7-3**.

Table 4.7-3 Acreage of Vegetation Types Where Current Groundwater Depth is Near Surface

Vegetation Type	Acres Where Groundwater is within 10 feet from the Surface
Desert Scrub	386
Grassland	113
Mesquite Upland Scrub	362
Riparian	54
Water	841
Woody Riparian	545

Mesquite Upland Scrub and Desert Scrub are the dominant vegetation types in the areas where the groundwater is currently within 40 feet of the surface. Where the groundwater is currently within 10 feet of the surface, the predominant vegetative community types are Woody Riparian and Mesquite Upland Scrub. The species in these areas are adapted to arid conditions but may use a combination of surface water and groundwater. While it is unknown which water source is used predominantly by the vegetative community types, it is likely in the areas where the groundwater is within 10 feet of the surface that these species use groundwater resources at some point in the growing season.

The vegetation composition and structure response of various vegetation communities to long-term drawdown stress varies depending on the underlying soil textures, chemistry, and water holding capacity; the relative influence of seasonal and annual precipitation; and the adaptations of individual species to drought stress. The response of the vegetation community types to the changes in soils moisture also is affected by the rate of groundwater drawdown while pumping occurs. Typically, the germination and survival of young plants is more dependent on the availability of steady water resources. Mature trees and shrubs are better adapted to surviving drought conditions and changes in water resources.

It is expected that drawdown-induced root zone stress would result in a successional sequence that would transition the riparian and woody riparian vegetative communities from wetland and riparian species to upland species better adapted to lower soil moisture levels. As soil moisture decreases, it is anticipated that water-dependent species would become less vigorous, and less able to compete against

upland species that would slowly take over these areas. Over the long term these areas would be invaded by less water dependent species and upland vegetation types, depending on the surface flow inputs, soil salinity, and alkalinity. Impacts would be seen sooner in herbaceous riparian communities where the species roots are shallower. The woody riparian species would potentially be able to follow the declining water table down with continued root growth to the limit of their root zones. For cottonwoods and willows the maximum root depth is typically 20 feet; these species would most likely start to decline once groundwater levels dropped below that point.

The grassland and desert scrub communities would most likely persist in this drawdown area, but would be less vigorous (lower height, lower densities, and lower reproductive potential). The upland mesquite scrub community would most likely persist in the drawdown area and may spread into areas that are being negatively impacted by drawdown effect. The mesquite tree has deep plastic roots that are capable of following the water table as it draws down, and also growing laterally to find pockets of surface water sources.

If drought conditions occur in the area, vegetation composition changes would increase. Recovery of these areas once groundwater pumping is stopped and the aquifer levels are returned to pre-project levels would depend on climate conditions, soil changes, and post-groundwater drawdown vegetation composition.

4.7.5.2 Invasive Plants

Indirect effects on vegetation would include the spread of noxious and invasive species, fugitive dust, and fragmentation of vegetative communities resulting from the development of the network of utility ROWs, access roads, and surface pipelines. In the areas disturbed by the Proposed Action, Malta star-thistle, African rue, Lehmann's lovegrass, and goldenrod have been identified along existing pipelines, and roads in the project area.

Surface disturbance and increased vehicle travel along new routes may readily spread noxious weeds and invasive plant species and colonize areas that have minimal vegetation cover or areas that have been recently disturbed. Noxious weed species can degrade and modify native communities, reduce resources for native species, and adversely affect native pollinators.

To stabilize the growth media, reduce soil erosion, and minimize the potential for the establishment of noxious weeds and invasive species, the operators would implement the applicant-committed environmental protection measures, as well as the BLM-required lease stipulations and environmental protection measures (Section 2.4.5), and compliance with the NPDES Construction General Permit plans.

Areas not needed for operations would be reclaimed as soon as construction activities are complete. During operation of the project, the lease stipulations require the operators to continue to identify areas where surface disturbances can be reduced. At the end of the project, all structures and infrastructure would be removed, and disturbed areas would be revegetated. During reclamation, caliche would be removed from the disturbed areas. Vegetation cover types would recover at varying rates, with herbaceous-dominated plant communities typically taking 3 to 5 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species and grazing operations.

Woody-dominated plant communities would require at least 20 to 40 years for shrubs to re-colonize the area. Reclamation efforts may take longer in some areas due to poor soil conditions, and changes in soil chemistry from groundwater drawdown, and potential spills during operation activities. In areas affected by groundwater drawdown, vegetation communities may take decades to recover to pre-project conditions, or may not return to pre-construction compositions, density, or structure due to permanent changes in soil chemistry.

4.7.5.3 Special Status Species

Scheer's Beehive Cactus

Scheer's beehive cactus is found in desert grassland and Chihuahuan desert scrub. These two vegetation communities occur in the project area, and would be impacted by surface-disturbing activities associated with the Proposed Action. **Table 4.7-4** identifies acres of potential habitat for the species in the project area based on SWReGAP landcover data. Due to the limited knowledge of the species, and its distribution, it is unknown whether the species occurs in the project area. If the species did occur in the project area, direct impacts from surface-disturbing activities would include the loss of individuals, and populations, and suitable habitat. Indirect impacts would result from the spread of noxious weeds, effects of fugitive dust, increased erosion, and potential changes in soil chemistry.

Table 4.7-4 Potential Scheer's Beehive Cactus Habitat

Vegetation Type	Acres of Temporary Impact	Percent of Project Area	Acres of Permanent Impact	Percent of Project Area
Desert Grassland and Chihuahuan Desert Scrub	377	1	300	1

Source: USGS 2004.

Gypsum Wild Buckwheat

Gypsum wild buckwheat is found in sparsely vegetated areas and is restricted to almost pure gypsum soils. Gypsum soils are found in the project area, and are impacted by surface-disturbing activities associated with the Proposed Action Alternative. **Table 4.7-5** identifies acres of potential habitat for the species in the project area based on NRCS SSURGO data (NRCS 2008a). Due to the limited distribution of the species, it is unlikely it is found in the project area.

Table 4.7-5 Potential Gypsum Wild Buckwheat Habitat

Vegetation Type	Acres of Temporary Impact	Percent of Project Area	Acres of Permanent Impact	Percent of Project Area
Gypsum Soils	128	<1	89	<1

Source: NRCS 2008a.

4.7.6 Alternative B

4.7.6.1 General Vegetation

Under Alternative B, impacts in the project area would be same as under the Proposed Action, except that the northernmost Rustler wells and pipelines would not be constructed. For this alternative, Caprock water from Intrepid's existing wells east of the project area would be used as either a supplemental or the primary water source. Intrepid has proposed three alternatives to transport the water to the project area. It is assumed that either Caprock pipeline option 2 or 3 would be implemented for the purposes of this EIS. Option 2 would improve Intrepid's existing main pipelines from the Caprock well fields to transport the water to the project area, and option 3 would be the installation of a new Caprock pipeline that would head south from the Caprock well fields, then parallel to NM 62/180 on the north side of the road until it enters the project area. **Table 4.7-6** summarizes the acreage of vegetation types affected under Alternative B for the three Caprock pipeline options up to the project area boundary.. The types

and extent of impacts to vegetation resources from surface disturbance activities in the project area would be similar to that described for the Proposed Action.

Table 4.7-6 Acreage of Vegetation Types within Project Area and Caprock Pipeline ROWs Affected by Construction under Alternative B

Vegetation Type	Acres of Temporary Impacts	Percent of Area Affected[1]	Acres of Permanent Impacts	Percent of Area Affected[1]
Project Area and New Caprock Pipeline ROW				
Desert Scrub	377	<1	274	1
Dune and Sand Flat Scrub	6	<1	—	<1
Foothill Shrubland	<1	<1	—	<1
Grassland	142	<1	36	<1
Mesquite Upland Scrub	736	2	492	1
Riparian	<1	<1	<1	<1
Sandhill Shrubland	44	<1	25	<1
Water[2]	3	<1	1	<1
Woody Riparian	6	<1	2	<1
Total	**1,314**	**3**	**830**	**2**
Project Area and Existing Caprock Pipeline Option				
Desert Scrub	387	<1	283	<1
Dune and Sand Flat Scrub	5	<1	2	—
Foothill Shrubland	0	—	<1	—
Grassland	154	<1	64	<1
Mesquite Upland Scrub	803	2	530	1
Riparian	<1	<1	<1	<1
Sandhill Shrubland	79	<1	30	<1
Water	2	<1	1	<1
Woody Riparian	4	<1	3	<1
Total	**1,435**	**4**	**914**	**2**

[1] Area affected includes project area plus Caprock pipeline ROWs listed.

[2] Includes water land cover type where ROWs overlap. Actual waterbodies would be avoided.

The impacts to vegetative resources from groundwater drawdown would be less under this alternative compared to the Proposed Action, because the majority of the groundwater drawdown would occur in areas where the groundwater table is greater than 40 feet below the surface (see **Figures 4.3-9** and **4.3-12**). See **Table 4.7-7** to view the vegetation community types that would potentially be affected by groundwater drawdown resulting from pumping the Rustler Formation and the additional Caprock wells for both pumping rates (preferred calibration, and enhanced calibration). Under Alternative B for the

Preferred Calibration, only four vegetative community types would be impacted (Desert Scrub, Grassland, Mesquite Upland Scrub, and Woody Riparian).

Table 4.7-7 Acreage of Vegetation Community Types Potentially Affected by Groundwater Drawdown, Alternative B

Vegetation Type	Acres Affected by Drawdown (where groundwater is currently within 40 feet of surface)	
	Preferred Model	Enhanced Model
Desert Scrub	483	1,579
Grassland	738	425
Mesquite Upland Scrub	1,332	3,282
Riparian	0	70
Sandhill Shrubland	0	6
Water	0	202
Woody Riparian	6	56

The acres of vegetation that are located where the groundwater is 10 feet or less from the surface are shown in **Table 4.7-8**. Only the Grassland vegetative type would be affected under the Preferred Model pumping for Alternative B.

Table 4.7-8 Acreage of Vegetation Types Where Current Groundwater Depth is Near Surface, Alternative B

Vegetation Type	Acres Affected by Drawdown (where groundwater is currently within 10 feet of surface)	
	Preferred Calibration	Enhanced Calibration
Desert Scrub	0	28
Grassland	94	9
Mesquite Upland Scrub	0	59
Riparian	0	5
Water	0	11
Woody Riparian	0	7

Mesquite Upland Scrub and Grassland are the dominant vegetation types in the areas where the groundwater is currently within 40 feet of the surface for the Preferred Model pumping rate. For the Enhanced Model pumping rate, the Mesquite Upland Scrub and Desert Scrub are the dominant vegetation types that would be affected by drawdown. Where the groundwater is currently within 10 feet of the surface, the predominant vegetative community types affected would be Grassland for the Preferred Model pumping rate, and Mesquite Upland Scrub and Desert Scrub for the Enhanced Model pumping rate. For the upland community types, impacts would be similar to those described for the Proposed Action.

4.7.6.2 Invasive Plants

Impacts in the project area under Alternative B would be similar to those described for the Proposed Action.

4.7.6.3 Special Status Species

Impacts to sensitive plant species from surface disturbance activities in the project area would be the same as described for the Proposed Action.

Scheer's Beehive Cactus

Table 4.7-9 identifies acres of potential habitat for the Scheer's beehive cactus species in the project area and for the pipeline routes (existing and proposed) under Alternative B based on SWReGAP landcover data.

Table 4.7-9 Potential Scheer's Beehive Cactus Habitat Affected under Alternative B

Vegetation Type	Acres of Temporary Impacts	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
With Proposed New Pipeline				
Desert Grassland and Chihuahuan Desert Scrub	420	1	297	1
With Existing Caprock Pipeline Option				
Desert Grassland and Chihuahuan Desert Scrub	420	1	308	1

Gypsum Wild Buckwheat

Table 4.7-10 identifies acres of potential habitat for the gypsum wild buckwheat species in the project area and for the pipeline routes (existing and proposed) under Alternative B based on SWReGAP landcover data and SSURGO data (NRCS 2008a).

Table 4.7-10 Potential Gypsum Wild Buckwheat Habitat Affected

Vegetation Type	Acres of Temporary Impacts (inside Project Area)	Percent of Project Area	Acres of Temporary Impacts[1] (outside Project Area)	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
Gypsum Soils	138	<1	0	0	89	<1

[1] Includes existing and proposed new Caprock pipelines.

4.7.7 Alternative C

Under Alternative C, impacts would be the same as under the Proposed Action. Surface disturbance acreages in the project area would be the same as for the Proposed Action. Interim reclamation would occur on the areas disturbed for construction of the pipelines and other facilities. Impacts from groundwater drawdown would be the same as those described for the Proposed Action.

4.7.8 Alternative D—Preferred Alternative

4.7.8.1 General Vegetation

The BLM selected aspects of Alternatives B and C to be included in the Preferred Alternative. Under the Preferred Alternative, there would be over 100 acres of additional long term surface disturbance associated with construction and operations, compared to the Proposed Action and 50 acres more, compared to Alternative B. All of the process plans would be the same as described for Alternative A, Proposed Action, but there would be some adjustments to the construction schedule. **Table 4.7-11** summarizes the acreage of the vegetation types affected within the project area under the Preferred Alternative. The types of impacts to vegetation resources from surface disturbance activities in the project area would be similar to those described for the Proposed Action.

Table 4.7-11 Acreage of Vegetation Types within Project Area and Caprock Pipeline ROW Affected by Construction under the Preferred Alternative

Vegetation Type	Acres of Temporary Impacts	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
Desert Scrub	404	1	299	<1
Dune and Sand Flat Scrub	5	<1	1	<1
Grassland	142	<1	65	<1
Mesquite Upland Scrub	723	2	558	1
Riparian	<1	<1	<1	<1
Sandhill Shrubland	48	<1	34	<1
Water	3	<1	1	<1
Woody Riparian	5	<1	3	<1
Total	**1,331**	**3**	**962**	**2**

The impacts to vegetative resources from groundwater drawdown under this alternative would be the same as described for Alternative B.

4.7.8.2 Invasive Plants

Impacts in the project area under Preferred Alternative would be similar to those described for the Proposed Action except that there would be an increased chance of invasive species spreading along the new Caprock Pipeline corridor.

4.7.8.3 Special Status Species

Impacts to sensitive plant species from surface disturbance activities in the project area would be the same as described for the Proposed Action.

Scheer's Beehive Cactus

Table 4.7-12 identifies acres of potential habitat for the Scheer's beehive cactus species in the project area under Preferred Alternative based on SWReGAP landcover data.

Table 4.7-12 Potential Scheer's Beehive Cactus Habitat Affected within the Project Area and Caprock Pipeline ROW

Vegetation Type	Acres of Temporary Impacts	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
Desert Grassland and Chihuahuan Desert Scrub	443	<1	326	<1

Gypsum Wild Buckwheat

Table 4.7-13 identifies acres of potential habitat for the gypsum wild buckwheat species in the project area under Preferred Alternative based on SWReGAP landcover data and SSURGO data (NRCS 2008a).

Table 4.7-13 Potential Scheer's Gypsum Wild Buckwheat Habitat Affected within the Project Area and Caprock Pipeline ROW

Vegetation Type	Acres of Temporary Impacts	Percent of Project Area	Acres of Permanent Impacts	Percent of Project Area
Gypsum Soils	135	<1	91	<1

4.7.9 Mitigation Measures

Recommended additional mitigation measures include the following:

- A noxious weed management plan should be developed that includes pre-construction surveys, education of construction and operation personnel, during construction activities the washing of vehicles and equipment before entering and leaving the project area, herbicide spraying, and annual monitoring.
- Surveys should be conducted in areas where surface disturbance is planned in or near potential habitat for Scheer's beehive cactus. If the species is identified as occurring in the disturbance footprint, surface-disturbing activities should be moved to be a minimum of 200 feet away from individual plants or populations.

4.7.10 Summary of Impacts

The greatest impacts to vegetation communities from drawdown would occur under the Proposed Action and Alternative C. The highest acreage of surface disturbance and alterations to vegetative cover would occur under the Preferred Alternative. There is a small potential for damage to sensitive plants that could be mitigated by implementing surveys prior to finalizing construction plans and locations. Implementation of a noxious weed management plan would minimize the potential for the spread and establishment of noxious weeds during construction activities and vehicle travel during project operations.

Residual impacts from surface-disturbing activities would include the permanent loss of 829 acres of native vegetation under the Proposed Action and Alternative C, 914 acres under Alternative B, and 962 acres under the Preferred Alternative. In addition, habitat fragmentation would be a result of the increased road and surface pipeline network. Noxious weed and invasive species may persist over the long term regardless of the implementation of control programs. Residual impacts from surface-disturbing activities for each alternative would be relatively the same.

Residual impacts from groundwater drawdown would include the potential for permanent conversion of wetland and riparian vegetation to upland communities. The communities may not return to pre-project conditions due to potential changes in soil chemistry, climate conditions, and changes in vegetation composition.

Impacts resulting from surface-disturbing activities and groundwater drawdown in combination would be likely to result in the spread of mesquite and other noxious or invasive weed species into disturbed areas.

4.8 Wildlife and Fish

4.8.1 Issues

Wildlife species and related issues addressed in this analysis were determined through consultation with the BLM and USFWS. The primary issues related to wildlife and fisheries include:

- Potential impacts to special status species, especially sand dune lizard, and lesser prairie-chicken that would contribute to their being listed as federally threatened or endangered.
- Disruption of natural mammal and reptile movement corridors and cumulative loss of habitat.
- Potential loss of raptor nest sites.
- Potential adverse impacts to migratory birds from the creation of hypersaline evaporation ponds.

4.8.2 Method of Analysis

Potential impacts to wildlife and sensitive species resources were determined based on the locations of these resources in relation to the proposed surface disturbance areas. Correlations between the vegetation types and habitat types were established. Using GIS, the locations of proposed surface disturbance were overlaid on the vegetation type layer to determine the amount of acreage lost for each habitat type.

To determine if known populations or individuals of special status species, would be affected, the locations of proposed surface disturbance were overlaid on known sensitive species GIS layers to determine if known populations or individuals would be located within the planned areas of disturbance. In addition, where appropriate and reasonable, suitable habitat was identified for each species where surface disturbance is projected to determine the amount of suitable habitat that would be lost due to the proposed project. Applicant-committed measures and BLM regulations were taken into account in determining significant impacts.

The potential impacts on terrestrial wildlife from implementation of the action alternatives can be classified as short-term and long-term. Short-term impacts may arise from habitat removal and disturbance as well as from activities associated with mine operations. These impacts would cease upon mine closure and completion of successful reclamation.

Long-term impacts consist of permanent changes to habitats and the wildlife populations that depend on those habitats, irrespective of reclamation success. Direct impacts to wildlife populations could include direct mortality caused by construction activities, habitat loss or alteration, incremental habitat fragmentation, animal displacement, and the potential for increased vehicle-related mortalities.

Indirect impacts could include increased noise and human presence.

4.8.3 Assumptions

The following summarizes the impact analysis assumptions for wildlife and sensitive species resources affected by the proposed project. The following assumptions were used in the analysis of impacts to wildlife and sensitive species resources:

- Installation of maintenance roads would increase disturbance of wildlife species and fragmentation of native habitat.
- Increased vehicle presence from the proposed project would contribute to disruption of wildlife populations and movement corridors.
- Installation of new power lines would increase the potential for migratory bird collisions with power lines. Additionally new power lines would increase the potential for roosting locations for raptors and other predatory birds.
- Installation and the continued use of saline evaporation ponds could increase the potential for migratory birds (and other terrestrial wildlife species) to attempt to use the ponds. Acute or chronic toxicity of migratory birds would occur if birds came into contact with hypersaline water in the evaporation ponds.
- Increased human activities and the increase in construction, maintenance, and utility corridors associated with the new mill, pumps, surface piping and evaporation ponds is likely to affect wildlife movement, use of native habitat, and increase the potential for wildlife mortality.

Environmental impacts to wildlife and fisheries would be significant if the alternatives result in any of the following:

- Disturbance of federally threatened or endangered terrestrial or aquatic wildlife species or their critical habitat, or disturbance of USFWS species of concern or BLM sensitive species contributes to their being listed as threatened or endangered.
- Adverse impacts to nesting raptor or passerine species protected under the MBTA, or loss of an active nest site, as a result of construction or operations during the breeding season.
- Destruction of active bat roosts or maternity sites.

The threshold for significant impacts to wildlife and sensitive species depend on the extent of surface impacts and the length of time necessary for native vegetative communities to recover following surface disturbance. Additionally, wildlife and sensitive species thresholds are dependent on the extent and duration of changes to habitat that would result from the long-term operation and maintenance of the proposed project. Impacts to wildlife or sensitive species would be significant if implementation of the proposed project results in one or more of the following:

- The loss of sensitive species populations or individuals that would adversely affect the ability of the species to maintain its current population status.
- Sensitive species habitat would be altered as part of the construction and maintenance of the proposed project.
- Migratory birds would be killed or damaged by project facilities.

4.8.4 No Action Alternative

Under the No Action Alternative, the proposed HB In-Situ Solution Mine Project would not be approved. Current land and resource uses would continue under current conditions in the project area. No additional ground-disturbing activities related to potash mining beyond those currently authorized would occur in the project area.

4.8.5 Alternative A—Proposed Action

4.8.5.1 Terrestrial Wildlife

Potential impacts to wildlife species from the Proposed Action would result from the incremental short-term loss of approximately 1,022 acres of habitat within the proposed project area. Impacts also would result in the long-term loss of approximately 829 acres of habitat from the construction of the pipelines, evaporation ponds, new HB mill, and other facilities needed to operate the proposed project. Other potential impacts to wildlife include increased vehicle traffic, increased human activity, increased exposure to hypersaline ponds, and increased habitat fragmentation within the project area.

Construction

Direct impacts to big game species (primarily pronghorn and mule deer) include the incremental loss of forage and would result in an incremental increase in habitat fragmentation from the installation of new roads and surface pipelines. However, these incremental losses of vegetation would represent a small percentage (less than 2.5 percent) of the overall available habitat within the project area.

The loss of native vegetation would be long-term, most likely greater than 20 years. Herbaceous species and grasses may become established within 3 to 5 years, depending on reclamation success. In most locations, suitable habitat adjacent to construction disturbance areas (i.e., new pipelines, transmission lines, maintenance roads, well pads, mill, and evaporation ponds) would be available for these big game species until grasses and woody vegetation are reestablished within the disturbance areas. The predominant vegetation that would be affected by construction disturbance is Mesquite Upland Scrub and Desert Scrub. They would be replaced by native grasses and herbaceous plants during initial reclamation and revegetation, which would attract big game species as well as many small game and nongame species that utilize grasslands and herbaceous feed and cover.

The construction of above-ground pipelines and associated roads would dissect the landscape and may alter travel routes for game species. Big game would not be adversely affected by this fragmentation for several reasons. The pipelines would be buried at least every quarter mile, so while this may alter some existing travel routes, the pronghorn and javelinas would be able to move along the pipe and cross at the locations where the pipe is buried, or mule deer could jump over the obstruction (18 inches or less). While the aboveground pipelines and roads would dissect the landscape, the patches created would be in areas of open vegetation that is similar on both sides of the pipelines and extending for long distances without creating edge effects. Direct impacts to small game species (e.g., scaled quail, bobwhite quail, black-tailed jackrabbit, and desert cottontail) would include nest or burrow abandonment or loss of eggs or young from the removal or crushing of natural habitat during construction due to disruption from human activity. Wildlife movements within the project area would be directly altered by the aboveground pipelines.

Construction would result in the mortality of some less mobile or burrowing nongame species (e.g., small mammals, nesting birds, reptiles, amphibians, invertebrates) as a result of crushing from vehicles and construction equipment. Other impacts include the short-term displacement of some of the more mobile species (e.g., medium-sized mammals, adult birds) as a result of surface disturbance activities. The habitats adjacent to the proposed disturbance areas may support some displaced animals.

If surface-disturbing activities occur near nesting sites during the breeding season for passerines (approximately March 1 through August 31), impacts would result in nest or territory abandonment, loss of eggs or young resulting in the loss of productivity for the breeding season. For species protected under the MBTA, the loss of an active nest site, incubating adults, eggs, or young would be a violation of the MBTA. However, the extent of impacts to nesting birds would depend on the nest location relative to the actual locations of construction, the phase of the breeding period, and the level and duration of the disturbance.

Nesting raptors located close to construction locations would be likely to abandon their breeding territory or nest site, or may experience the loss of eggs or young as a result of surface disturbance activities. These losses, if they were to occur, would reduce productivity for that breeding season. The degree of these impacts would depend on a number of variables including the location of the nest site, the species' relative sensitivity to disturbance, and breeding cycle.

New and rerouted overhead power lines could pose an electrocution hazard for raptor species attempting to perch on the structures and would slightly increase collision potential for migrating and foraging birds. Collision potential typically is dependent on variables such as the location of the power lines in relation to high-use habitat areas (e.g., nesting, foraging, and roosting), line orientation to flight patterns and movement corridors, visibility, and line design (APLIC 1994).

Indirect impacts would result from increased noise levels and human presence during construction. Big game animals (pronghorn and mule deer) would likely decrease their use within areas surrounding surface disturbance activities. However, this displacement would be short-term and animals would return to the area following construction activities. Indirect impacts would include the temporary displacement of small game from the construction areas as a result of increased noise and human activities. Displacement of small game animals from construction areas would be short-term and animals would return following construction activities where habitat remains available.

Potential impacts to big game species from construction activities would be minimized through implementation of the applicant-committed and BLM environmental protection measures summarized in Section 2.5.4. Potential impacts to nongame species from construction activities would be minimized through implementation of the mitigation measures identified at the end of this section along with the implementation of the BLM Environmental Protection Measures (2.3.1, Karst Features; 2.3.2, Surface Disturbance Buffer; and 2.5.2.1, Raptor Protection).

Operations

Direct impacts to many of the wildlife species from the operation and maintenance activities associated with the Proposed Action would include the incremental long-term habitat loss or alteration of potential breeding or foraging habitats until native vegetation has become reestablished.

The projected groundwater drawdown under the Proposed Action would cause changes to the vegetation types and the associated wildlife habitat in the locations identified in Section 4.7.5.1, Vegetation. Species that rely on habitat in the vegetation types that would be altered due to groundwater drawdown would be adversely affected. This includes the 836 acres of the grassland vegetation types, 762 acres of the riparian vegetation type, and 8,493 acres of the shrub-dominated vegetation types that would be affected by groundwater drawdown in the project area (see **Table 4.7-2**). Grasslands, riparian areas, and shrub-dominated vegetation provide habitat to mule deer and pronghorn, as well as most small game and nongame species currently located within the project area. Changes to this habitat would affect all species. However, because there is adequate habitat nearby, the impacts to wildlife would not be significant.

Big game species could be adversely affected if groundwater drawdown causes sources of natural fresh water locations to dry up, forcing species to travel greater than normal distances to find water. This situation may also entice wildlife to attempt to find new watering sources from the evaporation ponds, which would not be healthy.

The potential exposure of small mammals to hypersaline water in the evaporation ponds may result in acute or chronic salt toxicity. Once the new evaporation ponds become fully operational, salt levels within the ponds would become concentrated, much more than natural playa lakes in the region. Due to the lack of surface water bodies in the region, the evaporation ponds would be likely to attract a variety of migratory bird species, causing bird disease or mortality unless deterrents are employed. Any MBTA species that land on the hypersaline evaporation ponds are very likely to experience acute or chronic

toxicity.. Studies conducted on hypersaline playa lakes in southeastern New Mexico (Meteyer et al. 1997) during spring and fall migrations have shown that, “when birds remained on the lakes for prolonged periods of time, such as during stormy weather, a heavy layer of salt precipitated on their feathers. This precipitate was then ingested by the birds through frequent preening of salt-laden feathers,” causing sodium toxicity and often death. As little as 4 grams of salt can be lethal to birds (USFWS 2009b). According to the USFWS (Hudson 2010), the hypersaline tailings pond associated with a potash mine in the SPA caused high mortality rates of migratory birds until hazing and other mitigation measures were employed.

Indirect impacts to wildlife species would result from the increase in habitat disruption from the increase of vehicle traffic and human presence for operation and maintenance activities. The most common wildlife responses to noise and human presence are avoidance or accommodation. Avoidance would result in displacement of animals from an area larger than the actual disturbance area. It is not possible to predict the total extent of habitat lost as a result of wildlife avoidance response, because the degree of this response varies from species to species and can vary between different individuals of the same species. After initial avoidance of human activity and noise, certain wildlife species would acclimate to the activity and reoccupy areas formerly avoided. For example, during the initial development phases, it is likely that big game (pronghorn and deer) would be displaced from a larger area than the actual disturbance sites due to the avoidance response. Avoidance distances of 100 to 200 meters are common for some big game species (Lyon 1983). However, these big game species have demonstrated the ability to acclimate to infrequent vehicle traffic and a variety of mining activities as long as human harassment levels do not increase substantially. It is possible, therefore, that the extent of displacement would approximate the actual disturbance area along roads, wells, and in the mill area, after the first few years of project operations. As a result, impacts to wildlife species associated with human presence and noise would be low.

4.8.5.2 Aquatic Species

The project area has various wetlands, playas, salt ponds, and ephemeral streams. No detailed biological inventories have been performed in caves, but BLM specialists believe that the caves within and near the project area provide habitat for troglobitic species that rely on water. However, until an inventory is completed, it is unknown if the caves support aquatic species so no conclusion can be made regarding the potential impact on cave-dwelling aquatic species. The impacts of drawdown on caves are discussed further in Section 4.2.5.1.

Continued pumping of water from the Rustler wells may decrease water flows to the Pecos River downstream of the project area. Not enough is known about the relationship between flows from Nash Draw and flows in the Pecos River to determine whether instream river flows would be reduced or would affect aquatic species in the river.

4.8.5.3 Sensitive Species

The impact analysis for sensitive wildlife species focused on those species that were identified as potentially occurring within the project area (see **Table 3.8-1**). Impacts to species that could potentially be affected by the Proposed Action are presented below.

A total of 15 terrestrial species (5 special status species and 10 species of special concern) have been identified as potentially occurring within the project area. Without detailed data regarding the actual location of each of these species within the project area, it can only be concluded that potential impacts to sensitive wildlife species would parallel those discussed above for terrestrial wildlife in the construction and operations phases of the Proposed Action. No adverse effects to sensitive species are anticipated.

Implementation of the BLM Environmental Protection Measures (2.3.1, Karst Features; 2.3.2, Surface Disturbance Buffer; 2.5.2.1, Raptor Protection; 2.11.1.1, Raptor Nests and Heronries; 2.11.2.1, Prairie Chickens; and 2.11.2.2, Sand Dune Lizards) and mitigation measures identified below in Section 4.8.6,

would reduce potential impacts to sensitive wildlife resources. As a result, overall impacts to sensitive species are considered to be low.

4.8.6 Alternative B

4.8.6.1 Terrestrial Wildlife

Impacts to terrestrial wildlife from the construction and operation of Alternative B would be similar to the impacts outlined for the Proposed Action within the project area.

Additional impacts to wildlife species would occur from Alternative B because of the increased disturbance of native habitats from the proposed improvements to the Caprock pipelines. The excavation of the existing lines would initially affect 400 acres of native wildlife habitat. The disturbed vegetation within the ROW would be reestablished following excavation and no long-term disturbance would be incurred. If the new Caprock pipeline is implemented, 279 acres of native wildlife habitat would be altered initially. In addition, the new Caprock pipeline would require 84 acres of long-term disturbance for an access road in the pipeline ROW. Revegetation efforts would not be the same as pre-construction native environments for many years.

4.8.6.2 Aquatic Species

The impacts to aquatic species would be similar to or less than that described for the Proposed Action due to the less extensive groundwater drawdown in the vicinity of the project area.

4.8.6.3 Sensitive Species

In the project area, impacts to sensitive species from the construction and operation of Alternative B would be similar to the impacts outlined for the Proposed Action.

Current BLM management requires avoiding surface disturbance within any occupied or adjacent suitable habitat for the sand dune lizard. No surface disturbance is allowed in occupied habitat areas or within 100 meters (328 feet) of suitable habitat associated with occupied habitat areas. BLM management guidelines correspond to state and federal agency guidance to protect the sand dune lizard. Currently, the sand dune lizard is under consideration by the USFWS for formal listing as a threatened species, with the final decision expected in December, 2011. If the decision is made to list this species, then formal consultation will be initiated with the USFWS and a biological assessment will be developed to analyze the effect of the preferred alternative on the species and its habitat.

The existing Caprock pipelines are routed through occupied sand dune lizard habitat. The 50-foot ROW for the new Caprock pipeline does not cross occupied sand dune lizard habitat. BLM Environmental Protection Measure 2.11.2.2 would disallow excavation at many locations along the existing Caprock pipeline due to sand dune lizard habitat but would not preclude construction of the new Caprock pipeline based on current regulations. If critical habitat is designated as part of the federal listing decision, additional restrictions on construction of the new Caprock pipeline may be established at that time.

No surface disturbance is allowed within 200 meters (656 feet) of lesser prairie-chicken leks. The closest lesser prairie-chicken lek is approximately 240 feet away from the existing Caprock pipelines. The existing pipeline also lies within the area of BLM lesser prairie-chicken timing restrictions. BLM Environmental Protection Measure 2.11.2.1 would limit the timing of construction (not allowed from March 1 through June 15) and locations of improvements to the existing pipelines (not within 200 meters of lesser prairie chicken leks). The new Caprock pipeline ROW does not cross any leks or buffers. Portions of the line intersect with the BLM timing restriction area.

Compliance with environmental protection measures would likely minimize or avoid adverse effects to sensitive species under Alternative B. These restrictions may directly affect Intrepid's decision to

excavate the existing Caprock pipelines because there are few locations where excavation would not be constrained by sand dune lizard restrictions.

4.8.7 Alternative C

Impacts to terrestrial wildlife and special status species from the construction and operation of the proposed project under Alternative C would be similar to impacts outlined for the Proposed Action. By burying the pipelines, habitat fragmentation and other obstructions to wildlife movement would be lessened compared to the Proposed Action.

4.8.8 Alternative D—Preferred Alternative

4.8.8.1 Terrestrial Wildlife

The types of impacts to terrestrial wildlife from the construction and operation of the Preferred Alternative would be similar to the impacts outlined for the Proposed Action within the project area.

Additional impacts to terrestrial wildlife would occur under the Preferred Alternative as an additional 309 acres from initial impacts and 133 acres from long-term impacts would affect wildlife habitat in the project area. Construction of the new Caprock pipeline would result in 285 acres of native wildlife habitat that would be altered by construction activities. In addition, the new Caprock pipeline would have 85 acres of long-term disturbance associated with an access road in the pipeline ROW. Revegetation would not replace pre-construction native environments for many years. Similar to Alternative C, by burying 68 percent of the pipelines under the Preferred Alternative, habitat fragmentation and other obstructions to wildlife movement would be lessened compared to the Proposed Action.

Impacts to migratory birds and other wildlife species from exposure to hypersaline water may be more pronounced under the Preferred Alternative due to the increased surface acreage (additional 62 acres) of the evaporation ponds compared to the Proposed Action.

4.8.8.2 Aquatic Species

The impacts to aquatic species would be similar to or less than that described for the Proposed Action due to the less extensive groundwater drawdown in the vicinity of the project area.

4.8.8.3 Sensitive Species

Impacts to sensitive species from the construction and operation of the proposed project under the Preferred Alternative would be similar to impacts outlined for Alternative B. In addition, the new Caprock pipeline route would be installed along an alignment designed to avoid sand dune lizard habitat. Old Caprock lines would not be reconstructed but would be maintained as long as it does not require excavation in sand dune lizard habitat.

Compliance with environmental protection measures would likely minimize or avoid adverse effects to sensitive species under the Preferred Alternative.

4.8.9 Mitigation Measures

In order to minimize impacts to terrestrial wildlife, aquatic species, and special status species, mitigation measures have been developed in coordination with the BLM and USFWS. Recommended additional mitigation measures include the following:

- Eight-foot-high fencing should be installed around the evaporation ponds at the base of the earthen berms to minimize access by terrestrial wildlife species.
- Bird deterrents should be installed at the evaporation ponds to minimize potential impacts to avian wildlife species (Murphy 2010). Potential deterrents include:

  - Netting, pond covers, or floating “bird balls,” as appropriate.
  - Construct a mesh-net canopy over each pond to prevent access by birds.
  - Use trained dogs to harass birds from area.
  - Install a grid of gravel access roads to facilitate regular maintenance and hazing of birds.
  - Routine patrolling and firing shell crackers or other pyrotechnic devices.
  - Plant and manage tall, robust vegetation to discourage use by some waterbird species that typically loaf on land near water.
  - Install commercially available bird scaring devices employing noise or radar.
  - Install wire lines over ponds with reflective tape or ribbon. Monitoring of bird deterrents should be performed to evaluate their effectiveness and to allow for changes to measures through adaptive management should some mitigations prove unsuccessful.
- If watering locations within the project area dry up due to groundwater drawdown of the aquifer, install new watering facilities or provide supplemental water for use by wildlife species.
- Avoid removing large trees, large mesquite, and large yuccas (if present) to protect potential nesting habitat or coordinate with the BLM to identify alternative protection measures.
- Follow trenching guidelines developed by New Mexico Game and Fish Department to minimize mortality to reptiles and small mammals during buried pipeline and utility installation.
- Conduct surveys for sand dune lizard and lesser prairie-chicken along proposed pipeline routes that cross known habitat.
- Do not revegetate shinnery oak dune habitat where disturbed for installation of any Caprock pipeline.
- At the end of the project, remove all caliche from access roads and revegetate except in shinnery oak dune habitat.

Intrepid developed and is committed to implementing an avian monitoring and mitigation plan designed to anticipate and prevent use of the ponds by waterfowl and the resulting risk of mortality.

4.8.10 Summary of Impacts

Impacts to wildlife and sensitive species from the Proposed Action are expected to have a minimal effect on species populations. Although impacts would be minimal, there would be effects that could be long-lasting to certain wildlife species, especially small mammals, reptiles, and birds. Changes in plant communities would result from groundwater drawdown in riparian areas, as well as some grasslands and shrub habitats. These vegetation changes would be most prominent under the Proposed Action and Alternative C due to the extensive pumping of the Rustler Formation in the project area. The effect of groundwater drawdown on cave-dwelling species is unknown until biological inventories of the caves can be completed.

The installation of surface pipelines under the Proposed Action and Alternative B would block wildlife movements. In comparison, Alternative C and the Preferred Alternative would minimize adverse impacts to wildlife movements because a portion or all of the pipelines in the project area would be buried, depending on the alternative. Under the Preferred Alternative, the new Caprock pipeline would be installed along an alignment designed to avoid sand dune lizard habitat. The old Caprock pipelines would not be reconstructed but would be maintained as long as no excavation in sand dune lizard habitat is required. These measures would avoid adverse impacts to the sand dune lizard and its habitat.

Adverse impacts to wildlife and sensitive species that are common to all four action alternatives include increased vehicle traffic, increased noise levels, and drawdown of groundwater levels. The

implementation of the applicant-committed and BLM environmental protection measures, along with recommended mitigation measures, would minimize adverse impacts to wildlife and sensitive species to a point where impacts would not be significant.

4.9 Rangelands and Livestock Grazing

4.9.1 Issues

The primary issues associated with range resources include direct and indirect impacts associated with the loss of forage, potential impacts to existing water sources and range improvements, and potential impacts to seasonal livestock movement within grazing allotments.

4.9.2 Method of Analysis

Potential impacts to rangelands and livestock grazing resources were determined based on the locations of these resources in relation to the proposed surface disturbance areas. The locations of proposed surface disturbances, and potential subsidence areas were overlain on the grazing allotment and range improvement layers to determine the acreage lost of each grazing allotment, and which if any range improvements would be affected.

4.9.3 Assumptions

The following summarizes the impact analysis assumptions for rangelands and livestock grazing that would be affected by the proposed project. Impacts to rangelands and livestock grazing resources would be significant if the proposed project results in the permanent loss of AUMs or an allotment becoming non-functional (i.e., no longer able to support livestock grazing).

The following assumptions were used in the analysis of impacts to rangeland and livestock grazing resources:

- An increase in the number of roads and vehicular traffic would contribute to difficulties for livestock management and increase the potential for livestock-vehicle collisions.
- Loss of water sources may decrease the AUMs that could be grazed on an allotment or may require supplemental water to be provided.
- Aboveground pipelines would not severely restrict cattle access to grazing because they would be buried at least every 0.25 mile.
- Surface disturbance and the long-term existence of surface pipelines and other facilities would reduce the AUMs in grazing allotments.
- Applicant-committed measures, required lease stipulations, and Conditions of Approval required by BLM policy and guidelines (see Section 2.5.4) were taken into account in determining impacts.

4.9.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be approved. Grazing management would continue as currently authorized. No additional surface disturbance or effects on groundwater withdrawal related to potash mining beyond those currently authorized would occur in the project area.

4.9.5 Proposed Action

Under the Proposed Action, impacts to range resources would result from surface-disturbing activities including the construction and operation of well pads, pipelines, overhead utilities, and roads, and the impacts on surface water resources and vegetative communities resulting from the decrease in the groundwater depth due to pumping. **Table 4.9-1** identifies the acreage of initial disturbance per

allotment, the number of livestock AUMs affected per allotment, and the percentage of AUMs that would be lost from surface-disturbing activities under the Proposed Action. The number of AUMs lost was calculated based on an average number of AUMs per acre for the grazing allotment acreage lost. Initial disturbance associated with surface-disturbing activities would result in impacts to 1,022 acres on five BLM grazing allotments, resulting in the loss of 125 AUMs over the life of the project. The loss of AUMs in each allotment is less than 1 percent, except in the Maroon Cliffs grazing allotment. Permanent disturbance would result in the long-term loss of 829 acres and 81 AUMs in the project area. Most of the AUMs lost in the Maroon Cliffs allotment are on private land owned by Intrepid.

Table 4.9-1 Impacts to Carrying Capacity by Allotment Due to Initial Disturbance under the Proposed Action

Grazing Allotment Name	Allotment Disturbance in Project Area (ac.)	Active AUMs Lost in Project Area (no.)	Percent Loss of Total Active AUMs
Clayton Basin	78	16	<1%
Fenton Draw	9	1	<1%
Maroon Cliffs	711	86	4%
Mimosa	6	1	<1%
Twin Wells North	218	21	<1%
Total	**1,022**	**125**	

Groundwater withdrawals would affect 836 acres of the Grassland vegetation type, 762 of the Riparian vegetation types, and 8,493 of the Shrub-dominated vegetation community types (see **Table 4.7-2**). Groundwater withdrawals would decrease the amount of water available for livestock water sources, especially base water wells and groundwater wells located in allotments affected by the groundwater withdrawals. In the project area, the grazing allotments under Section 3 of the Taylor Grazing Act are permitted with water as the base property. To qualify for a Section 3 grazing permit, the permittee must have land or water capable of serving as the base for livestock operations (base property), which is defined as either land or water controlled or owned by the permittee. In the project area, there are five base water wells that could lose their water supply or be severely reduced by project-related groundwater pumping (see **Table 3.9-4**). Outside the project area, there are an additional two base water wells that could be adversely affected by groundwater drawdown in the Clayton Basin and Brushy Knob grazing allotments.

Reductions in the base water wells would affect the terms of the grazing permits and could potentially lead to a reduction in AUMs allowed for the grazing allotment unless an alternate water source were identified to serve as the base property for the grazing permit. In addition, due to the semi-arid climate and lack of reliable water sources in much of the project area, a decrease in the water available to supply groundwater wells that serve as livestock water sources is likely to reduce the areas available for grazing. Without a reliable water source, many areas currently available for grazing would not be able to support livestock.

Direct effects from construction and operation activities would result from surface-disturbing activities, increased vehicle traffic, possible damage to range improvements (fences, gates, and water sources), and increased road and utility networks. Surface-disturbing activities would result in the short-term loss of forage from facility construction, and long-term loss from the placement of permanent facilities, and the potential conversion of native vegetative communities due to impacts from increased erosion and invasion and spread of noxious and invasive weed species. Vegetation treatment projects in the north

and east parts of the project area could be affected by surface-disturbing activities associated with construction and operation activities.

An increase in the number of roads and traffic could lead to increased mortality and injuries to livestock, and may cause disruptions to livestock management. Construction and operation activities may disrupt livestock management by limiting access to grazing areas and range improvements, and may restrict or alter livestock movements.

The loss of forage may result from changes in vegetation communities due to groundwater drawdown. See Section 4.7, Vegetation and Section 4.3, Water, for a further discussion on the effects of groundwater pumping on surface water resources and vegetation composition.

Indirect impacts would include the potential spread of noxious and invasive species, fugitive dust, and the fragmentation of grazing allotments. Following surface-disturbing activities, noxious weeds and invasive plant species may readily spread and colonize areas that typically lack or have minimal vegetation cover or areas that have been recently disturbed.

4.9.6 Alternative B

Under Alternative B, impacts to the project area would be similar to the Proposed Action, except that the northernmost Rustler wells and pipelines would not be constructed. For this alternative, Caprock water from Intrepid's existing wells east of the project area would be used as either a supplemental or the primary water source. **Table 4.9-2** summarizes the acreage of initial disturbance per allotment, the number of livestock AUMs affected per allotment, and the percentage of AUMs that would be lost from surface-disturbing activities under Alternative B for both the existing and proposed new Caprock pipeline routes. Impacts to range resources from surface disturbance activities in the project area would be slightly less than that described for the Proposed Action. In the existing and proposed new Caprock pipeline ROWs, surface disturbance and changes to range resources in BLM allotments would be greater outside the project area than under the Proposed Action.

Table 4.9-2 Impacts to Carrying Capacity by Allotment Due to Initial Disturbance under Alternative B

Grazing Allotment Name	Allotment Disturbance (ac.)	Active AUMs Lost (no.)	Percent Loss of Total Active AUMs
With Proposed New Caprock Pipeline			
Buckeye North	30	<1	<1
Buckeye South	24	No Data	No Data
Clayton Basin	94	21	<1
Fenton Draw	9	1	<1
Halfway	16	4	<1
Hart Ranch	38	1	<1
Laguna Tonto	21	11	<1
Laguna Totson	13	4	<1
Maljamar II	1	<1	<1
Maroon Cliffs	711	86	4
Mimosa	6	1	<1
Salt Lake	18	No Data	No Data
Twin Wells North	242	23	<1

Table 4.9-2 Impacts to Carrying Capacity by Allotment Due to Initial Disturbance under Alternative B

Grazing Allotment Name	Allotment Disturbance (ac.)	Active AUMs Lost (no.)	Percent Loss of Total Active AUMs
Total	1,223	152	6
With Existing Caprock Pipeline Option			
Buckeye North	38	<1	<1
Buckeye South	33	No Data	No Data
Clayton Basin	166	34	<1
Fenton Draw	9	1	<1
Halfway	15	3	<1
Laguna Tonto	21	10	<1
Laguna Totson	9	2	<1
Little Lake	4	<1	<1
Maljamar II	26	2	8
Maljamar South	34	3	<1
Maroon Cliffs	736	88	4
Mimosa	6	1	<1
Querecho Plains	9	1	<1
Salt Lake	34	No Data	No Data
Twin Wells North	274	26	<1
West Bilbrey	15	2	<1
Total	**1,429**	**173**	**14**

Note: Not all of the Caprock pipelines fall within BLM grazing allotments, so total acreage affected is less than the total amount of surface disturbance under this alternative.

If the existing Caprock lines are no longer used to transport water to the project area and the processing plants, a few ranchers that obtain water from these lines based on informal agreements with Intrepid may lose a source of water for livestock grazing. Intrepid may choose to provide an alternative water source for livestock grazing based on a private agreement if the existing Caprock pipelines are retired from use.

The groundwater drawdown would be less extensive in the project area than under the Proposed Action and would not have a major effect on forage availability because most of the drawdown would occur in areas where the existing groundwater table is greater than 40 feet below the surface (see **Figures 4.3-9** and **4.3-12**). Impacts to base water and groundwater wells would be less than that described under the Proposed Action due to the smaller extent of groundwater drawdown.

4.9.7 Alternative C

Under Alternative C, impacts would be the same as under the Proposed Action, except that all pipelines would be buried. Surface disturbance acreage would be the same as for the Proposed Action, with more initial excavation. Interim reclamation would occur on the areas disturbed for the construction of the pipelines. Once successful reclamation is achieved in these areas, livestock grazing could be resumed. Impacts to livestock management during the life of the project would be less than under either the

Proposed Action or Alternative B, mainly because there would be no surface pipelines blocking livestock movements or excluding the use of forage along the pipeline ROWs.

4.9.8 Alternative D—Preferred Alternative

Under the Preferred Alternative, impacts to the project area would be similar to the Proposed Action, except that there would be additional surface disturbance associated with construction and operation activities under this alternative. Greater surface disturbance increases the chance of the spread of invasive species along the new Caprock pipeline corridor. The BLM selected aspects of Alternatives B and C to be included in the Preferred Alternative. This alternative includes approval of Intrepid's revised HB In-Situ Solution Mine Operation and Closure Plan, granting new ROWs, approval of lease modifications, and approval of permits to drill new water supply, injection, extraction, and monitoring wells. All of the process plans would be the same as described for Alternative A—Proposed Action but there would be some adjustments to the construction schedule. For further discussion of the Preferred Alternative, and the specific differences between the Preferred Alternative and the Proposed Action see Section 2.2.5. **Table 4.9-3** identifies the acreage of initial disturbance per allotment, the number of livestock AUMs affected per allotment, and the percentage of AUMs that would be lost from surface-disturbing activities under the Preferred Alternative. The number of AUMs lost was calculated based on an average number of AUMs per acre for the grazing allotment acreage lost. Initial disturbance associated with surface-disturbing activities would result in impacts to 1,272 acres on thirteen BLM grazing allotments, resulting in the loss of 148 AUMs over the life of the project. The loss of AUMs in each allotment is less than 1 percent, except in the Maroon Cliffs grazing allotment. Permanent disturbance would result in the long-term loss of 944 acres and 94 AUMs in the project area.

Table 4.9-3 Impacts to Carrying Capacity by Allotment Due to Initial Disturbance under the Preferred Alternative

Grazing Allotment Name	Allotment Disturbance in Project Area (ac.)	Active AUMs Lost in Project Area (no.)	Percent Loss of Total Active AUMs
Buckeye North	30	<1	<1
Buckeye South	24	-—[1]	-—[1]
Clayton Basin	112	20	<1
Fenton Draw	9	1	<1
Halfway	16	3	<1
Hart Ranch	42	2	<1
Laguna Tonto	22	11	<1
Laguna Totson	13	4	<1
Maljamar II	1	<1	<1
Maroon Cliffs	736	88	4
Mimosa	10	1	<1
Salt Lake	18	-—[1]	-—[1]
Twin Wells North	239	19	<1
Total	**1,272**	**148**	

[1]Active allotment information is not available for this grazing allotment.

Note: Not all of the Caprock pipelines fall within BLM grazing allotments, so total acreage affected is less than the total amount of surface disturbance under this alternative.

4.9.9 Mitigation Measures

Impacts to grazing allotments would be minimized through the implementation of the applicant-committed environmental protection measures, the lease stipulations and environmental protection measures required by BLM policy and guidelines, and the NPDES Construction General Permit. During construction, these measures would minimize surface impacts, soil erosion, and the potential for the establishment of noxious weeds and invasive species. Surface disturbance would be minimized by the utilization of existing surface disturbance, minimization of total surface disturbance, and the co-location of pipelines along existing roads and ROWs. Restrictions to livestock movement would be minimized by the burying of the pipe every quarter mile to wildlife and livestock crossings.

Range improvements would be avoided, or moved if avoidance is not feasible. If livestock water sources cannot be avoided, they would be moved a minimum of 200 feet away from construction and operation activities. Any fences damaged during construction would be repaired. If a range improvement is found to be within the construction footprint, impacts to the range improvement would be minimized by avoidance or moving it if avoidance is not feasible. If livestock water sources cannot be avoided, they would be moved a minimum of 200 feet away from construction and operation activities.

Areas not needed for operations would be reclaimed as soon as construction activities are complete. During operation of the project, the lease stipulations require the operators to continue to identify reductions in surface disturbances and the reclamation of these areas. Final reclamation would occur at the end of the life of the project. All structures and infrastructure would be removed, and disturbed areas would be revegetated. During reclamation, caliche would be removed from the disturbed areas. Re-establishment of herbaceous species would take 3 to 5 years, while tree and shrub species could take 20 to 50 years. Once successful reclamation has been achieved in these areas, livestock grazing could be resumed.

Vegetation treatment projects seek to increase native grasslands, and reduce the cover and number of invasive native and non-native shrubs (creosote, mesquite, and tamarisk). Successful reclamation of these areas with native grasses and forbs could assist in restoring the native grasslands in these historically disturbed areas. Recommended additional mitigation measures include the following:

- Speed limits should be followed and signs would be erected to warn vehicle operators of construction and project-related traffic.
- Exclusion fencing around the evaporation ponds should be installed to keep livestock out during construction and project operation.
- If the supply to base water and other water wells is sufficiently decreased by groundwater withdrawals so the Section 3 grazing permits are adversely affected or there is a long-term decrease in the level of active AUMs, then alternative water sources should be provided or developed by Intrepid.

4.9.10 Summary of Impacts

The primary impacts to rangelands and livestock grazing would be reductions in forage and changes to livestock movements. The greatest impacts would occur under the Proposed Action and Alternative B because the aboveground pipelines would occupy space currently used for forage and would block livestock movements. The Preferred Alternative would have greater surface disturbance than the Proposed Action, but would have a decreased impact on forage availability and animal movement due to the burial of 68 percent of the pipelines in the project area. Alternative C, with its buried pipelines, would allow for more forage availability, and less blockage to animal movements, although the new access roads may affect travel patterns. No alternative would result in significant impacts to rangelands or livestock grazing. The adverse impacts from groundwater pumping would be minimized through the mitigation measures.

Residual impacts would include the loss of up to 1,429 acres and 148 AUMs associated with the Caprock pipeline ROWs over the life of the project, depending on which Caprock pipeline option is selected. Other residual impacts include the establishment of noxious weed and invasive species unless weed management is implemented. Noxious weed and invasive species may persist over the long term regardless of the implementation of control programs, thus resulting in the reduction of available forage. The increased number of roads and pipelines would fragment the allotments and alter livestock movements, and may result in an increased number of vehicle-livestock collisions.

See Section 4.7, Vegetation, for a discussion of the residual impacts from groundwater pumping on the vegetation communities.

4.10 Lands and Realty

4.10.1 Issues

Land use issues associated with the proposed project include:

- Surface disturbance and visual resource alterations that are inconsistent with land use plans.
- New roads along pipelines may increase public access where none previously existed.
- Subsidence may affect existing and future land use and access in the project area.
- Increased traffic on Highway 62/180, as well as on local roads.

4.10.2 Method of Analysis

Analysis of impacts to lands and realty was completed primarily using a qualitative evaluation of how the proposed project would affect current land uses and transportation in the project area and the region. Using GIS, the projected subsidence areas were overlaid on the land ownership and existing infrastructure to identify structures that might be affected.

4.10.3 Assumptions

Assumptions for analysis are as follows:

- New roads within pipeline ROWs would increase public access and may promote unauthorized use.
- Project-related vehicle traffic would temporarily affect public traffic on highways to/from Carlsbad and local roads within the project area.
- New ROWs may limit the locations of future land use changes.
- Large-diameter pipelines would limit emergency vehicle access.
- Existing infrastructure (i.e., pipelines and roads) could be impacted by subsidence.
- Actions that impede present land and mineral uses authorized by the 1986 Order would have an adverse impact on land use and transportation.

4.10.4 No Action Alternative

Under the No Action Alternative, in-situ mining activities would not take place within the project area so there would be no change to lands, realty, and transportation activities beyond the currently authorized activities.

4.10.5 Alternative A—Proposed Action

The proposed project and alternatives would affect lands managed by the BLM, the State of New Mexico, Intrepid, and other private landowners. Land ownership in relation to proposed project facilities is displayed on **Figure 2-1**. New ROW authorizations would be required where pipelines, roads, wells, and power lines, and other infrastructure would be located on BLM lands. Three overhead power lines owned by Xcel, two buried New Mexico Gas pipelines, and one AT&T fiber optic line in the vicinity of the proposed evaporation ponds would have to be moved before construction begins. The total length of the ROWs to be relocated can be found in **Table 2-3**. The establishment of these new ROWs may limit other future land uses that require facilities in the project area for the life of the solution mining project (28 years). Other uses common in the area that could be affected include OHV trails and oil and gas development.

New access roads would not be gated so they would open up public access for unauthorized OHV or other vehicle use. Furthermore, aboveground pipelines may be considered a challenge or an obstacle to be crossed by aggressive motorized and non-motorized vehicle riders. Both of these unauthorized uses would require increased BLM signage and enforcement.

While subsidence resulting from the Proposed Action is projected to be minimal, it may affect current land uses such as existing oil and gas infrastructure. The Colglazier 2 Oil Well is slightly within the potential subsidence area, and there is an oil pipeline connecting several wells with tank batteries that slightly overlaps the projected subsidence area. Additionally, an oil pipeline runs northwest and southeast through the area of potential subsidence. There are no residences or outbuildings within the projected subsidence area.

Pipelines would be installed under NM 360 at four locations and under U.S. 62/180 at two locations within the project area. Because the pipelines would be bored under the roads, little or no interruption of traffic would occur during construction.

Heavy equipment would be mobilized and moved into and out of the project area, depending on specific activities, during the 18-month construction period. During some construction activities, there would be frequent traffic to and from Carlsbad by such vehicles as concrete trucks and service trucks, in addition to the daily travel by construction workers. While the greatest impact to transportation would be increased traffic and the use of new and existing roads during construction, the current traffic to, from, and within the project area is relatively light and well within the capacity of the existing roads.

During project operations, service vehicles would check pipelines using the roads within the pipeline ROWs daily. Once potash is produced in the evaporation ponds (beginning approximately 3 years after construction of the project), there would be large scrapers driving between the ponds and the salt loadout area, and periodic trips by 24-ton tractor trailer trucks along a private haul road between U.S. 62/180 and the new HB mill. There also would be daily travel by the employees (36) to the new HB mill. The effect of additional project-related travel on area roads during construction and operations would not significantly affect normal traffic levels.

4.10.6 Alternative B

Under Alternative B, impacts would be similar to that described for the Proposed Action. In order to provide more water from existing wells, Intrepid would either build a single new Caprock pipeline or would replace existing buried Caprock pipelines within the same ROWs. These pipelines would cross U.S. 62/180, NM 529, and CR 222/Shugart Road. Because the pipelines would be bored under the roads, little or no interruption of traffic would occur during construction. The construction of the new Caprock pipeline would add 46 miles to the existing pipeline network within the Carlsbad Field Office jurisdiction. The excavation and installation or replacement of the Caprock pipelines crosses primarily public land, but also small portions of state and private land.

New permits and ROW authorizations would be required to enter state land for any of the pipelines, and a new BLM ROW permit would be required where they cross public lands. Permission to enter private lands would require separate negotiations between Intrepid and private landowners. Intrepid would be responsible for obtaining all permits and ROW grants from the appropriate agencies.

As a result of implementation of either pipeline option, a temporary increase in vehicle traffic between the project area and the Caprock well fields by construction employees would be expected.

4.10.7 Alternative C

Under Alternative C, all pipelines would be buried but BLM ROW permits would still be required for all project facilities on public lands. Potential safety hazards caused by motorized and non-motorized vehicle rider potential use of aboveground pipelines would not occur under Alternative C. The new access roads along the pipeline ROWs would still provide increased public access to the area, requiring BLM enforcement. There would be slightly fewer impacts than the Proposed Action.

4.10.8 Alternative D—Preferred Alternative

Under the Preferred Alternative, impacts in the project area would be similar as those described for Alternative B, except that 68 percent of the proposed pipelines in the project area would be buried. This would result in greater potential safety hazards caused by motorized and non-motorized use than under Alternative C, but fewer safety hazards than under the Proposed Action and Alternative B due to the removal of surface obstructions.

Potential impacts from the new Caprock Pipeline and maintenance of the existing Caprock pipelines would be the same as described in Alternative B. Pipelines would be installed under NM 360 at four locations and under U.S. 62/180 at three locations within the project area with little or no interruption of traffic during construction. Intrepid would be responsible for obtaining all permits and ROW authorizations from the appropriate agencies (the BLM or the State of New Mexico) or individual landowners to install the new Caprock pipeline.

4.10.9 Mitigation Measures

Additional mitigation measures are not needed.

4.10.10 Summary of Impacts

Impacts would be similar across all action alternatives, but slightly more under the Proposed Action and Alternative B, mainly due to the existence of the aboveground pipelines, which would require additional BLM enforcement and may result in constraints on other land uses for the life of the proposed project.

Because no additional mitigation measures are appropriate, the residual impacts would be the same as the direct and indirect impacts discussed under each alternative above.

4.11 Recreation

Primary recreational activities in this area are associated with hunting, hiking, and OHV use. The Hackberry SRMA receives the highest recreational use within the project boundary.

4.11.1 Issues

Recreation issues associated with the proposed project include:

- Concern for the effects on the use of recreation areas such as Hackberry SRMA (e.g., OHV use and access limited by aboveground pipelines, visibility of aboveground structures).
- Reduction in access to dispersed recreation activities such as hunting, biking, camping, off-highway driving, and special events on public lands.
- Pipeline ROWs and access roads may become unauthorized OHV routes.
- Subsidence may affect recreational uses in the project area.
- Reduction in recreational use of the area and tourism due to project-related traffic.

4.11.2 Method of Analysis

GIS analysis was used to identify the location and size of the SRMA that is within the project area boundary. Using GIS, the projected subsidence areas were overlaid on the SRMA to identify which areas might be affected.

4.11.3 Assumptions

Assumptions for analysis are as follows:

- Aboveground pipelines would limit access, as well as affect OHV use, and hunting quality and opportunities by altering normal traffic patterns for vehicles and wildlife.
- Impact analysis must be qualitative due to the lack of accurate recreation use numbers for the project area.

4.11.4 No Action Alternative

Under the No Action Alternative, in-situ mining activities and the associated new facilities would not be developed within the project area. Potash mining would continue with the current methods, and impacts to recreation would not change.

4.11.5 Alternative A—Proposed Action

Surface disturbance generated by construction would potentially affect recreation activities such as dispersed camping and hunting for big game, deer, dove, quail, and varmints. Construction activities would generate increased noise and traffic primarily during the day, which may temporarily diminish camping and hunting activities. The presence of new aboveground facilities also would potentially diminish the hunting experience by displacing habitat as well as increasing noise and human presence.

Increased project-related traffic on both access roads and BLM roads may tend to reduce tourism and recreational uses in the area. This impact is likely to be minor due to the users being accustomed to existing mineral development and operations within the project area.

The Hackberry SRMA receives the highest level of recreational use within the project area. Public access to this area may be impeded by increased project-related traffic, especially during construction. Also, increased vehicle and heavy equipment travel in the immediate area of the SRMA may pose a risk to OHV operators on access roads. Production facilities such as new roads, power lines, and pipelines can interrupt existing recreation trail use. They also can be a hazardous obstacle to OHV users traveling along trails. Pipelines would cross existing OHV trails approximately nine times. Two of these crossings would occur in the vicinity of HB South, three in HB North, and four adjacent to HB Crescent. The aboveground pipelines would present a risk to OHV use in the project area by obstructing OHV travel,

but the planned burial of pipelines at designated locations would minimize impacts to OHV use and recreation.

Approximately 5 percent, of the Hackberry SRMA lies within the area of potential subsidence. Subsidence resulting from the Proposed Action is expected to be minimal, and is unlikely to affect recreational uses in the Hackberry SRMA because subsidence would be gradual. Uneven ground surface or open cracks in the surface that may result from subsidence may present a safety hazard to OHV riders, but this type of subsidence has already occurred in the project area without adverse effects to recreational users. Slightly changing the terrain may improve the OHV experience.

4.11.6 Alternative B

Under Alternative B, impacts would be the same as described for the Proposed Action in the project area. As a result of construction of either Caprock pipeline option, a temporary increase in construction vehicle traffic would extend into Lea County. This impact to recreational uses in the region would be minimal. All other potential impacts to recreation would be the same as under the Proposed Action.

4.11.7 Alternative C

Obstacles to OHV travel, hiking, or wildlife traffic caused by aboveground pipelines would not occur under this alternative, resulting in fewer impacts than under the Proposed Action. The projected impacts due to subsidence, increased public access on new access roads, and increased construction and operational vehicle traffic would be the same as that described for the Proposed Action.

4.11.8 Alternative D—Preferred Alternative

Under the Preferred Alternative, impacts in the project area would be similar to those described for Alternative C. With 68 percent of the all the pipelines in the project area buried under the Preferred Alternative, and all of the pipelines within the Hackberry SRMA buried, there would be fewer safety hazards for recreational vehicle users and fewer limitations on the development of new OHV trails. Therefore, there would be fewer long-term recreation impacts than under the Proposed Action and Alternative B.

4.11.9 Mitigation Measures

Mitigation measures that would minimize the impacts to recreational users include the following:

- If subsidence cracks that may affect riders and hikers occur, signage and trail maintenance should be implemented in affected areas.
- To minimize conflicts with recreational users, construction should not occur within the Hackberry Lake SRMA during the organized OHV event in September or on weekends during periods of active OHV use.
- Aboveground pipelines should be buried under trails to extend at least 20 feet on either side of the trail. Pipelines should be buried as soon as possible and visible signage should be placed on either end of the trail during construction to warn approaching riders.

4.11.10 Summary of Impacts

Under all alternatives except No Action, there would be an expanded road network within the project area, increased vehicle traffic, OHV safety concerns associated with subsidence and new structures, and an increased potential for unauthorized OHV use along new access roads. These impacts would decrease by the end of the proposed project, as facilities are decommissioned, portions of the project area are reclaimed, and new subsidence areas stabilize.

4.12 Visual Resources

4.12.1 Issues

- Changes in the landscape due to new surface pipelines, booster stations, and electrical connections.
- Consider impacts to foreground, middle ground, and background.
- Consider whether changes in scenery would impact the overall recreation experience by visually altering the natural environment.

4.12.2 Methods of Analysis

The visual quality of the scenic resource in the project area was rated by analyzing the relative worth of the affected landscape from a visual perception point of view. Key factors considered were landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modifications. The result of this rating for the project area was a Scenic Quality Classification of C, which is the lowest. This scenic quality classification was compared to an estimate of what the area would look like if the proposed facilities were built.

4.12.3 Assumptions

Assumptions for analysis are as follows:

- Any surface facility would potentially alter the viewshed. The degree of change would be based on line, form, color, and texture of the facility.
- All injection and extraction wells would not significantly alter the viewshed.
- Changes would be considered significant if alterations dominate the landscape.
- Impacts to visual resources would be minimized through implementation of the relevant BLM environmental protection measures.

4.12.4 No Action Alternative

Under the No Action Alternative, in-situ mining activities and the associated new facilities would not be developed within the project area. Potash mining would continue with the current methods, and changes to the viewshed would be consistent with the other structures and current land uses in the landscape.

4.12.5 Alternative A—Proposed Action

Impacts to the visual landscape from the implementation of the Proposed Action would result in slight to moderate modifications of the viewshed due to the addition of evaporation ponds, roads, aboveground pipelines, new mill, and well pads. The proposed evaporation ponds would be highly visible from Maroon Cliffs as well as the Hobbs Highway (U.S. 62/180). Long-term visible impacts would be caused by alteration of the landscape by man-made linear features that would add to the number of lines present in the landscape, mainly access roads and surface pipelines. These lines are not characteristic natural features, but they are currently present in the project area. A recent internal BLM report indicated the proposed project would not change the Scenic Quality classification of the project area.

Construction activities would potentially produce dust that may temporarily reduce visibility, but this would be minimized if a dust control plan were implemented, as recommended in Section 4.5.8, Air Quality.

4.12.6 Alternative B

Under Alternative B, impacts in the project area would be the same as that described for the Proposed Action. In order to provide more water from existing wells, Intrepid would either build a single new Caprock pipeline or would replace existing buried Caprock pipelines within the same ROWs. There would be additional temporary impacts to visual resources due to the visibility of the installation or replacement of the Caprock pipelines. As reclamation and revegetation of the disturbed areas progresses, the disturbance along the Caprock pipelines would fade into the background.

4.12.7 Alternative C

Under Alternative C, all pipelines would be buried, resulting in fewer impacts that are visible on the land surface. As reclamation and revegetation of the disturbed areas progresses, the disturbance along the buried pipelines would fade into the background. The proposed surface structures would still be constructed; however, due to the burial of the pipelines there would be fewer changes to the viewshed than under the Proposed Action over the long term.

4.12.8 Alternative D—Preferred Alternative

Under the Preferred Alternative, impacts in the project area would be similar to those described for Alternative C. Burial of 68 percent of the proposed pipelines in the project area would result in greater long-term visual impacts than under Alternative C, but fewer long-term visual impacts than the that described for the Proposed Action and Alternative B. Potential visual impacts from the new Caprock pipeline and maintenance of the existing Caprock pipelines would be the same as described for Alternative B.

4.12.9 Mitigation Measures

No additional mitigation measures are needed beyond the BLM environmental protection measures summarized in **Table 2-9** and described in more detail in **Appendix B**.

4.12.10 Summary of Impacts

Under all alternatives, the visible impacts would be mainly from alteration of the landscape by man-made features creating lines and pools of water not previously present in the landscape. With the exception of the evaporation ponds, similar man-made features currently exist in the project area. Intrepid would comply with BLM visual resource management requirements to minimize impacts. Impacts are not expected to be incompatible with current BLM VRM objectives.

4.13 Cultural Resources

4.13.1 Issues

Primary issues of concern include actions that result in adverse effects to properties listed or eligible for listing on the NRHP or considered important to Native American groups. These actions include:

- Ground-disturbing activities
- Subsidence
- Erosion
- Illegal collection of artifacts
- Vandalism
- Unanticipated discoveries

4.13.2 Methods of Analysis

Analysis of impacts to cultural resources was performed by reviewing reports of cultural resource investigations that have been completed in the project area, some of which were conducted for Intrepid specifically for the proposed project.

4.13.3 Assumptions

- Class III field inventories will be conducted for all proposed disturbance areas prior to construction.
- Cultural resource protection and mitigation will be in accordance with the terms of the Protocol Agreement. On state land, cultural resource protection and mitigation will be in accordance with the New Mexico Cultural Properties Act, as amended (NMSA 1978, §§18-6-1 through 18-6-17).
- Resources or sites of tribal concern will be protected in accordance with tribal consultation requirements and other federal regulations.
- Where avoidance is not possible, mitigation measures will be developed based on the Protocol Agreement.
- The BLM will continue tribal consultation throughout the environmental review and construction phase of the proposed project, if approved. Renewed contacts with some or all of the tribes may result from unanticipated discoveries.

4.13.4 No Action Alternative

Under the No Action Alternative, the project would not be approved and the existing potash leases would not be modified. Current land and resource uses would continue under current conditions in the project area. No additional ground-disturbing activities beyond those currently authorized would occur in the project area. Prior to construction of the authorized facilities, adverse effects to NRHP eligible sites located in the area of the facilities would be fully mitigated in accordance with the Protocol Agreement. Therefore, no effects to NRHP-eligible sites are anticipated under the No Action Alternative.

4.13.5 Alternative A—Proposed Action

Section 106 of the NHPA requires that federal agencies take into account the effect of an undertaking on historic properties and provide the ACHP an opportunity to comment. Historic property, as defined by the regulations that implement Section 106, means “any prehistoric or historic district, site, building, structure, or object included, or eligible for inclusion, in the NRHP maintained by the NPS.” The term includes properties of traditional religious and cultural importance to any Native American tribe or Native Hawaiian organization that meet the National Register criteria.

Potential impacts to NRHP-eligible sites are assessed using the “criteria of adverse effect” (36 CFR 800.5[a][1]): “An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association.” There are five broad categories of effect:

1) Physical destruction or alteration of a property or relocation from its historic location;
2) Isolation or restriction of access;
3) Change in the character of the property’s use or of physical features within the property’s setting, or the introduction of visible, audible, or atmospheric elements that are out of character with the significant historic features of the property;
4) Neglect that leads to deterioration or vandalism; and

5) Transfer, sale, or lease from federal to non-federal control, without adequate and legally enforceable restrictions or conditions to ensure the preservation of the historic significance of the property.

Under NEPA, effects to NRHP-eligible sites can be direct or indirect. Direct effects are caused by an undertaking and occur at the same time and place (40 CFR 1508.8[a]). These types of effects to NRHP-eligible sites include physical damage resulting from surface-disturbing activities and can occur to both known sites and subsurface sites. Indirect effects are caused by an undertaking and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). These types of effects often are not quantifiable and can occur both within and outside of the APE. Indirect effects to NRHP-eligible sites include, but are not limited to, changes in erosion patterns due to construction activities, inadvertent damage due to off-road maintenance traffic, and illegal artifact collection due to increased access to an area.

4.13.5.1 Potential Effects

Although effects to NRHP-eligible sites are determined on a site-specific basis, certain activities that are associated with the Proposed Action have a greater potential to adversely affect these sites than do others. Ground-disturbance associated with construction of the processing mill, well pads, utility conveyances, evaporation ponds, access roads, and water pipelines could result in direct effects to NRHP-eligible sites. These effects could result in the vertical and horizontal displacement of soil containing cultural materials and the resulting loss of integrity, loss of information, and the alteration of a site's setting.

Potential indirect effects to NRHP-eligible sites located within or outside of the project APE could include erosional effects from runoff or mine water discharge, off-road travel associated with construction and maintenance activities, and illegal collection, inadvertent damage, and vandalism due to increases in both surface disturbance and the number of people in the project area. Other potential indirect effects could include subsidence as a result of mineral extraction. Subsidence could damage archaeological sites, affect the stratigraphic integrity of buried archaeological deposits, and adversely affect the integrity of a site's setting. In addition, subsidence could affect surface drainage flow resulting in erosional impacts to surface and subsurface archaeological sites. Erosion and subsequent redeposition can produce a secondary deposit of archaeological material that contains no contextual integrity. The reader is referred to Section 4.2, Geology and Minerals, for a detailed discussion of the potential for subsidence to occur as a result of the proposed project.

The potential for the discovery of unanticipated archaeological deposits during construction activities exists within proposed disturbance areas and could result in direct effects. Unanticipated discoveries could result in displacement or loss (either complete or partial) of the discovered material. Displacement of archaeological deposits affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric settlement and subsistence patterns.

The Proposed Action may result in the loss of archaeological sites that are not eligible for the NRHP through surface-disturbing activities during construction. These sites would be recorded to BLM standards and the information integrated into local and statewide databases.

4.13.5.2 Resolution of Effects

At this time, no Class III inventories have been conducted for the proposed locations of the mill processing facilities, water pipelines, and utility conveyances associated with the proposed project; all other proposed project components have been inventoried. Inventories of proposed project components not yet inventoried would be completed prior to project construction. Evaluative testing at three NRHP-eligible prehistoric sites located during previous inventories was completed in late fall 2009. Laboratory analysis of the data collected during testing currently is ongoing. Results of the testing and

laboratory analysis will determine the need for additional archaeological work (e.g., data recovery) at these sites.

Avoidance would be recommended for NRHP-eligible sites that may be located during the remaining Class III inventories of the mill processing facilities, water pipelines, and utility conveyances. If avoidance is not possible, the BLM would determine whether construction of the proposed project would have an adverse effect on these sites. If the BLM determines that the sites would be adversely affected, then mitigation would be proposed in accordance with the Protocol Agreement. Potential indirect effects to NRHP-eligible sites located within and outside of the APE as a result of runoff or water discharge are anticipated to be minor based on the surface water control system and implementation of erosion control measures required under the NPDES permit. In compliance with the applicant-committed environmental protection measures, vehicle access would utilize existing roads to reduce the potential for indirect impacts associated with off-road vehicle travel during construction and maintenance activities. To minimize the potential for illegal collection of artifacts, vandalism, and inadvertent damage, the project proponent and their construction supervisor would inform all employees and subcontractors that archaeological sites are to be avoided by all personnel, vehicles, and equipment, and that it is illegal to collect, damage, or disturb cultural resources on federal land.

To minimize potential impacts associated with subsidence, Intrepid installed survey monuments to monitor subsidence over the 25-year life of their proposed in-situ solution mine. The project consisted of setting approximately 75 monuments at just aboveground level along 5 transects. Measurements would be made at each station approximately twice a year for up to 25 years. A Class III cultural resource inventory was conducted in conjunction with the surveying of the route and placement of the monuments. All NRHP-eligible sites were avoided during installation of the monuments. See Section 4.2, Geology and Minerals, for an expanded discussion of the subsidence monitoring program and its potential to reduce subsidence impacts in the future.

As provided in the applicant-committed environmental protection measures, if any previously unknown archaeological sites are discovered during construction on BLM-administered lands, all construction activities would cease in the area of the discovery, and the BLM Authorized Officer would be notified of the find. Steps would be taken to protect the site from vandalism or further damage, such as fencing or other security measures, until the BLM Authorized Officer could evaluate the nature of the discovery. Effects to NRHP-eligible sites discovered during construction would be mitigated through data recovery per the Protocol Agreement. If construction or other project personnel discover what might be human remains, funerary objects, or items of cultural patrimony on federal land, then construction would cease in the area of the discovery, and the BLM Authorized Officer and local BLM law enforcement officer would be notified of the find within 24 hours. Steps would be taken to protect the remains from vandalism or further damage, such as fencing or other security measures. Any discovered Native American human remains, funerary objects, or items of cultural patrimony found on federal land would be handled in accordance with the NAGPRA.

If human remains and associated funerary objects are discovered on private or state land during construction activities, construction would cease within the area of the discovery and the county coroner or sheriff would be notified of the find. Treatment of any discovered human remains and associated funerary objects found on private or state land would be handled in accordance with the provisions of the New Mexico Cultural Properties Act, as amended (NMSA 1978, §18-6-11.2).

4.13.6 Alternative B

Alternative B would include all of the facilities described for Alternative A (Proposed Action) with the exception of the northernmost Rustler wells and pipelines, which would not be included under this alternative. Intrepid's existing pipelines from the Caprock well fields would be replaced with new pipe within the same ROWs to transport the water to the project area. Replacement of the existing buried concrete pipelines would result in more ground disturbance compared to the Proposed Action. More

ground disturbance would increase the potential for direct impacts to cultural resources that may be eligible for the NRHP. Class III cultural resources inventories of the water pipelines would be required prior to ground disturbance. If NRHP-eligible sites are located during the inventories and cannot be avoided, potential impacts would be mitigated as described above for the Proposed Action.

Another possible option under Alternative B is to install a new Caprock pipeline to provide supplemental project water. Class III inventories would be required along the entire proposed new pipeline route prior to pipeline construction. If NRHP-eligible sites are located during the inventories and cannot be avoided, potential impacts would be mitigated as described above for the Proposed Action.

4.13.7 Alternative C

Under Alternative C, Intrepid's proposal would be modified to bury all of the water pipelines in the project area. The layout of the pipeline system would be the same as described for Alternative A (see Section 2.4.2, Alternative A—Proposed Action). More excavation would be required to bury the pipelines but the total acreage of surface disturbance would be the same as the Proposed Action due to clearing of vegetation and grading required within the ROWs. Additional excavation would increase the potential to discover and impact buried cultural remains. Class III inventories of the water pipelines would be conducted prior to ground-disturbing activities. Mitigation of potential impacts would be the same as described for the Proposed Action.

4.13.8 Alternative D—Preferred Alternative

In terms of surface disturbance, impacts to cultural resources under the Preferred Alternative essentially would be the same as Alternative B. Class III inventories would be conducted for all areas not previously inventoried prior to the start of surface-disturbing activities. If NRHP-eligible sites are located during the inventories and cannot be avoided by project construction, potential impacts would be mitigated as described for the Proposed Action.

4.13.9 Mitigation Measures

The following mitigation measures should be implemented:

- One NRHP-eligible prehistoric lithic, ceramic, and groundstone scatter was located near a proposed well location. Although no additional investigation of the site is necessary, an archaeological monitor is recommended during project construction to protect the site from potential damage. Project construction should not begin prior to arrival of the monitor.
- To protect NRHP-eligible sites located adjacent to project construction, fencing should be erected between the site and construction activities.
- A BLM-approved archaeological monitor would monitor project construction in areas with the potential for buried cultural remains. The BLM would determine which areas require a monitor. Project construction should not begin prior to arrival of the monitor.

4.13.10 Summary of Impacts

The Proposed Action and Alternatives B and C may result in the loss of archaeological sites that are not eligible for the NRHP. Although these sites would be recorded to BLM standards and the information integrated into local and statewide databases, the sites ultimately would be destroyed by project construction. Ineligible sites have no legal protection and their destruction is not generally considered an adverse impact.

NRHP-eligible sites identified within proposed disturbance areas would be avoided or, if avoidance is not possible, mitigated in accordance with the NHPA. Although NRHP-eligible sites would be mitigated

through implementation of data recovery, some of the cultural value associated with these sites cannot be fully mitigated; therefore, it is anticipated that residual impacts to these resources would occur.

Indirect effects, such as illegal collecting of artifacts, have occurred and most likely would continue to occur in the project area through increased access, development, and increased human presence, as a result of past, present, and reasonably foreseeable future actions.

4.14 Hazardous Materials, Health and Safety

4.14.1 Issues

Hazardous materials, health, and safety issues associated with the proposed project include:

- The potential for a spill to contaminate water and soil resources.
- The potential for a spill to harm employees and members of the public at the spill site.
- Unauthorized personnel entering areas where active mining operations are taking place.
- Public endangerment from subsidence.
- Increased traffic on local and area roads.

4.14.2 Method of Analysis

The mine plan and other relevant documents were reviewed to determine how hazardous materials and solid wastes are currently handled at Intrepid plants in the region and how they would be handled if the proposed project were approved. The potential risk for contamination of soil and water resources from spillage or improper disposal was determined qualitatively based on existing plans.

4.14.3 Assumptions

Assumptions for analysis are as follows:

- Intrepid will draft a project-specific emergency response plan.
- Employees will be trained in safety procedures and will be expected to follow all established safety procedures.
- Intrepid will draft a project-specific SPCC Plan.
- If some of the chemicals identified for use during the life of the proposed expansion were to enter the environment in an uncontrolled manner, there could be associated direct or indirect adverse effects.

4.14.4 No Action Alternative

Under the No Action Alternative, in-situ mining activities would not take place within the project area. Existing emergency response and spill plans for current potash mining operations would continue to be implemented.

4.14.5 Alternative A—Proposed Action

Under the Proposed Action, the transport, storage, use, and disposal of hazardous materials for mine operations would continue for the 28-year life of the project and through site closure and reclamation.

4.14.5.1 Health and Safety

Precautions would be taken to ensure the health and safety of the public as well as mine employees. A controlled entrance to the mine site would allow access to only authorized personnel. The new HB mill

would be fenced to protect against vandalism and to protect against the entrance of unauthorized personnel. Intrepid employees would be required to take multiple forms of safety training and adhere to safety regulations.

Because subsidence related to the Proposed Action is projected to be minimal, it would most likely not be a health and safety concern to land users, particularly in the Hackberry SRMA. Aboveground pipelines may present a public health and safety threat to OHV users, and may require increased BLM signage and possibly enforcement. In the Hackberry SRMA, pipelines would be buried at designated locations to minimize health and safety impacts.

Increased traffic would occur as a result of construction and operations potentially resulting in a health and safety risk; however, it is anticipated that the increase in traffic would not greatly affect normal traffic levels.

4.14.5.2 Hazardous Materials

Storage and Use

Intrepid has SPCC plans for existing operations at the West, East, and North plants. These plans are in compliance with 40 CFR Part 112, which describes the required level of containment and safety measures associated with storage, handling, and spill clean-up of oil, including but not limited to petroleum, fuels, sludge, used oil, and mineral oil (Intrepid Potash, Inc. 2010d). A similar SPCC Plan would be prepared for the in-situ solution mine operations and new HB mill. Operations conducted in accordance with the SPCC Plan would ensure that impacts from spills would be minimized and the spilled materials would be contained and removed. Intrepid would have the necessary spill containment and cleanup equipment available at the site, and personnel would be able to quickly respond.

All hazardous substances would be handled in accordance with applicable MSHA regulations (Title 30 CFR). The hazardous materials to be used under the Proposed Action would be handled as recommended on the manufacturer's Material Safety Data Sheets. Based on the facility's design features and the operational practices in place, the probability of a major release occurring at the site during the life of the proposed solution mine project would be low.

Disposal

All hazardous waste generated at the mine would be transported to licensed disposal facilities in accordance with applicable federal and state regulations. Other solid wastes would be disposed of appropriately depending upon waste type.

Potential Effects of a Release

The environmental effects of a release would depend on the material released, the quantity released, and the location of the release. Potential releases could include a small amount of diesel fuel spilled during transfer operations at the mine site to the loss of several thousand gallons of diesel fuel or reagent into a riparian drainage.

The release of a hazardous material or waste into a sensitive area such as stream, wetland, or populated area is judged to be very unlikely. Depending on the material released, the amount released, and the location of the release, an accident resulting in a release could adversely affect soils, water, biological resources, and human health.

Response to a Release

All spills, including transportation and loading/unloading spills occurring on site, would be cleaned up as soon as possible. If a spill exceeds the reportable quantity, it would be reported to the New Mexico Environment Department, USEPA, National Response Center, and the BLM.

In the event of a release on the way to the facilities in the project area, the transportation company would be responsible for response and cleanup. Law enforcement and fire protection agencies also may be involved to initially secure the site and protect public safety. Hazardous materials transporters are required to maintain an emergency response plan, which details the appropriate response, treatment, and cleanup for a material spilled onto land or into water.

For on-site spills, the procedures outlined in the SPCC Plan would be used to respond to petroleum and fuel spills. Specific procedures would be developed for other hazardous materials to stored and used at the mine and the mill. Any cleanup would be followed by appropriate restoration of the disturbed area, which could include replacing removed soil, seeding the area to minimize erosion, and the return of the land to its previous use.

4.14.6 Alternative B

There would be no difference in health and safety concerns or hazardous materials use and solid waste generation under this alternative as compared to the Proposed Action. Therefore, the potential impacts would be the same as described for the Proposed Action.

4.14.7 Alternative C

There would be no difference in health and safety concerns or hazardous materials use and solid waste generation under this alternative as compared to the Proposed Action. Therefore, the potential impacts would be the same as described for the Proposed Action.

4.14.8 Alternative D—Preferred Alternative

There would be no difference in health and safety concerns or hazardous materials use and solid waste generation under this alternative as compared to the Proposed Action. Therefore, the potential impacts would be the same as described for the Proposed Action.

4.14.9 Mitigation Measures

A project-specific emergency response plan should be prepared for the new HB mill and in-situ solution mining operations.

4.14.10 Summary of Impacts

Effects from the use of hazardous materials under the all action alternatives would depend on the substance, quantity, timing, location, and response involved in the event of an accidental spill or release. Operation in compliance with applicable regulations and in accordance with the facility's SPCC Plan, and the prompt cleanup of potential spills and releases would minimize the potential for impacts under all alternatives.

4.15 Socioeconomics and Environmental Justice

4.15.1 Issues

The primary issues associated with socioeconomic resources include direct or indirect impacts to the local economy in terms of jobs, local labor markets and income, effects on other economic activities, population trends and migration, housing markets, public facilities and services, public sector fiscal resources, and social conditions in the region. Short and long-term effects would result from the temporary construction and long-term operating jobs associated with the proposed In-situ Solution Mine Project and the capital investments made by the applicant. Indirect socioeconomic effects would arise from the incremental demands for goods and services and circulation of money in the region supported by the direct jobs and investments.

4.15.2 Method of Analysis

The assessment process of project-induced effects on social and economic values included review and analysis of existing conditions and trends in population and demographics, migration, economic activity, employment, labor force participation, earnings and income, poverty, land use, housing, local government facilities, services and fiscal conditions, social structure and attitudes and opinions. Information was compiled from available secondary sources, augmented by interviews with local officials and residents. Additional information for the social assessment was obtained from BLM scoping documents and attendance at scoping and other public meetings.

For the assessment of effects of construction and operations of the proposed surface facilities, evaporation ponds, and mill, potential social and economic effects were identified by review and extrapolation of information contained in Intrepid's plan of development, and by considering the location and timing of work force and construction activities in the context of existing social and economic conditions and community and housing capacities. This portion of the assessment was informed by community experience with other natural resource development and construction projects, both within the project area and in other locations. Potential revenues associated with the construction and operations of the HB In-Situ Solution Mine Project were considered for their potential to offset public costs of providing goods and services to the construction and operations work forces.

For this assessment, estimated employment and payroll provided by the applicant were the primary inputs for a regional economic assessment process using the IMPLAN economic modeling software. IMPLAN is an input-output based model originally developed to assist the USFS in land resource management planning. Subsequently, the model and related software were transferred into the private sector, where it is the subject of ongoing refinement and enhancements to provide the analytical capacity to address a broader range of economic and impact planning issues. IMPLAN is widely recognized and accepted in regional economic and economic impact assessment circles. The model maps the flow of dollars through the region's economy and provides information about the interaction of individual sectors within the regional economy. The model considers both the direct effects on the producing sector(s) of a change in economic activity and the secondary effects on other local sectors due to the linkages within the region's economy. The model is widely used for NEPA assessments and BLM planning initiatives across the west.

IMPLAN assumes that current relationships between sectors will remain similar in the future. The model does not consider potential changes in other sectors of the economy unless they also are specified as inputs. For this assessment, only the economic activity associated with the Proposed Action was considered in the IMPLAN modeling process. As noted below, the activities associated with the Proposed Action have the potential to have minor adverse effects on other economic activities such as grazing and outdoor recreation within the planning area. These potential effects are not addressed within the IMPLAN modeling process but are discussed in the following sections.

Applicant committed measures, and BLM regulations were taken into account in determining significant impacts.

4.15.3 Assumptions

The following criteria are used to determine whether socioeconomic impacts of the action alternatives and the No Action Alternative would be significant.

- An increase in county or community population that would strain the ability of affected communities to provide housing and services or otherwise adapt to growth-related social and economic changes.

- An aggregate change in public sector revenue and expenditure flows likely to result in an inability on the part of affected units of government to maintain public services and facilities at established service levels.
- Permanent displacement of residents or users of affected areas that would result from project-induced changes in or conflicts with existing uses or ways of life.
- Disproportionately high and adverse environmental or human health impacts to an identified minority or low-income population, which appreciably exceed those to the general population around the project area.

4.15.4 No Action Alternative

The No Action Alternative describes future conditions in the project area assuming denial of the requested ROWs for the proposed project. Denial would preclude Intrepid from recovering the mineral resource in the existing mine workings unless another practical method could be found to extract the resource. This would result in a foregone economic opportunity for the company, one having economic and social implications for the community and fiscal implications for federal, state and affected local governments—although the EIS only focuses on the more localized effects as an assessment of the broader implications is beyond the scope of this analysis.

From a social and economic perspective, the No Action Alternative represents a hypothetical "status quo" scenario in which the future unfolds absent the discrete actions and effects associated with Intrepid's HB In-Situ Solution Mine Project. Essentially, the No Action Alternative assumes continuation of the existing economic drivers and influences affecting Eddy County, Carlsbad, and surrounding region. These include, but are not limited to the following:

- Potash production from Intrepid's currently permitted West Mine and East Mine operations
- Oil and gas development, maintaining the historical average rate of 75 new wells per year
- Operation of the Federal Law Enforcement Training Center
- Long-term operation of the WIPP
- Seasonal tourism and recreation, the former being anchored by Carlsbad Caverns and Guadalupe Mountains National Parks
- Louisiana Energy Services National Enrichment Facility
- Lifestyle migration

However, it also acknowledges uncertainties introduced by currently unknown factors and events that could exert even greater influences on growth and development in the assessment area over the long term. Perspectives regarding those influences may vary widely among individuals, groups, and organizations.

4.15.4.1 Economic Effects

Continuation of the key economic drivers listed above would be anticipated to sustain the region's economy for the foreseeable future, providing a relative high degree of economic vitality and diversity for its residents and a fiscal foundation for local government. Factors that potentially could support future growth include a higher pace of lifestyle migration, which could trigger a resumption of residential construction, and an increase in the pace of oil and gas development in the region.

Intrepid's current operations include approximately 629 employees (October 2009), substantial investment in plant and equipment and annual production capacity in excess of 850,000 tons of potash and langbeinite. Current estimates of proven and probable reserves support remaining life of mine

forecasts of 120 to 130 years for the existing West Mine and 43 to 57 years for the East Mine (Intrepid Potash Inc. 2009).

The No Action Alternative would be subject to the restrictions and requirements of the 1986 Order (*Federal Register* 1986) and OCC Order R-111-P. Oil and gas development and its associated local employment, income, and economic activities are contingent upon future permitting and environmental compliance and on energy prices to support such activity, particularly given the environmental and safety constraints and concerns associated with potash mining areas. The No Action Alternative would effectively preclude extraction of potash from the inactive workings, absent some other practical recovery method.

4.15.4.2 Population and Demographics

Population projections prepared by the UNM-BBER in 2008 anticipate moderate long-term growth for Eddy County, with net growth of nearly 7,500 residents projected between 2010 and 2035 (UNM-BBER 2008). The rate of projected growth in Eddy County is considerably lower than forecasts for the Albuquerque metropolitan area, but higher than most rural areas of the state.

4.15.4.3 Housing

The No Action Alternative would not affect housing in the analysis area. Anticipated baseline population growth would require additional long-term residential development, but such development is consistent with the long-term plans adopted by local governments.

4.15.4.4 Public Infrastructure, Services, and Local Government Fiscal Conditions

Eddy County, local municipal governments and school districts engage in long-term planning efforts intended to prepare for growth and economic development. These efforts, and the plans that result, establish the groundwork for capital improvement programs and provision of public facilities and services in a fiscally responsible manner. The Eddy County Comprehensive Plan, last updated in 2008 (Eddy County 2008), and the Greater Carlsbad Housing Analysis and Strategic Plan (City of Carlsbad 2009) are both predicated on long-term growth. Supporting the existing potash mining and oil and gas industries and their role in the region's economic, social, and fiscal framework is consistent with the achievement of such growth. So too is the pursuit of further long-term economic growth and diversification. Implementation of the No Action Alternative would avoid the short- and long-term demands associated with the project-related incremental growth, but also an incremental increase in public sector revenues. The magnitude, timing, and net implications of the future demands and growth are uncertain.

4.15.4.5 Social Organization and Conditions

Current social conditions and trends in the analysis area would be unaffected by implementation of the No Action Alternative. Potentially affected groups including grazing operators, hunters, and OHV users of the project area would similarly not be affected. Oil and gas operators with current, historical, and potential future interests within the project area would likely be satisfied with implementation of the No Action Alternative.

Implementation of the No Action Alternative would effectively eliminate a source of concern about potential increased subsidence associated with the injection of water into subsurface formations for some Eddy County residents.

4.15.4.6 Environmental Justice

The continuation of current economic activities and social trends under the No Action Alternative would not be anticipated to result in any disproportionately high adverse human health and environmental

effects on minority or low-income populations in the region. Consequently, environmental justice concerns would not be expected under the No Action Alternative.

4.15.5 Proposed Action

Implementation of the Proposed Action would involve short-term construction of proposed improvements over a 14- to-18-month period, followed by a 28-year operations period during which flooding and subsequent pumping of underground workings, evaporation, and mineral precipitation, and final processing would occur. Intrepid estimates additional investment of $120 million to $130 million to implement the Proposed Action, with ongoing production costs of between $11.4 million and $13.9 million during a typical year. Reclamation would follow the completion of production. The social and economic effects described below would be incremental effects to those associated with Intrepid's current operations.

4.15.5.1 Economic Effects

Relocation of existing power, natural gas, and fiber optic lines, development of evaporation ponds, construction of a new mill, and work to put additional water pumps, transmission lines and other support facilities in place will support short-term construction related jobs in the local economy, both directly and indirectly. Project timetable and direct employment estimates provided by Intrepid call for 91 jobs during the initial quarter of construction activity. Thereafter direct employment increases to an anticipated peak of 274 jobs, primarily in conjunction with construction of the new mill and evaporation ponds. Employment would remain at approximately the same level for a year until construction is substantially completed, declining to about 20 jobs to finalize completion of the evaporation ponds (**Figure 4.15-1**) (Intrepid Potash Inc. 2011).[1]

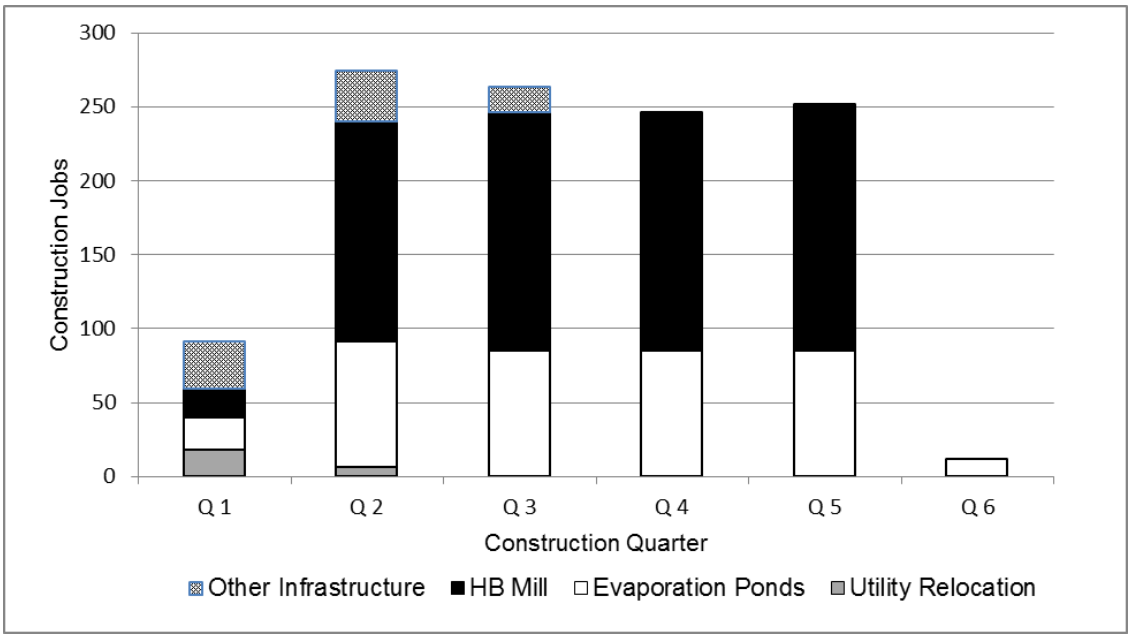


Figure 4.15-1 HB In-Situ Project Estimated Direct Construction Jobs

[1] Further perspectives on the potential economic impacts associated with the proposed project can be found in "The Economic Impacts of Intrepid Potash, Inc.'s Proposed HB Solar Solution Mine Project in Eddy County, New Mexico", 2011. The report was prepared by J. Peach, et al, at the Arrowhead Center, New Mexico State University under contract to Intrepid Potash, Inc.

Intrepid anticipates expanding its existing operational work force of 629 employees (October 2009) by 36 positions in conjunction with the Proposed Action. Hiring for operations would likely begin in the latter stages of construction, with the added jobs continuing over the 28-year anticipated productive life of the In-Situ Project. Reclamation following the completion of production would provide an unspecified number of short-term jobs.

Through a process commonly known as the "economic multiplier," purchases of machinery, equipment, and supplies by Intrepid Potash and its contractors, along with purchases of goods and services by the company's employees and those of its contractors would indirectly support other jobs in the surrounding economy. Based on the size and composition of the current economy and the industrial linkages between the mining industry and other sectors of the economy, the IMPLAN model estimates that an additional 74 jobs are supported in the regional economy for every 100 construction jobs and associated investment. The IMPLAN multiplier for operational jobs is 0.54 secondary jobs. Job multipliers in the mining industry are commonly higher than those associated with construction. In Eddy County the converse applies, apparently a reflection of the high capital investment associated with the new mill and the use of solar evaporation in the production process, rather than more technology intensive processes. The net results of the multiplier effect would be short-term support of an additional 68 jobs during the initial phase of construction, with the number increasing to an average of 194 jobs during the 12 months of highest construction activity.

The total short-term stimulus associated with the Proposed Action is estimated to be 179 jobs during the first quarter of construction activity, increasing to an average of 453 jobs during the subsequent 12 months of higher construction activity (see **Figure 4.15-2** and **Table 4.15-1**). The majority of these jobs would be based in Eddy County, although Lea County would likely realize some benefit from the jobs based on economic linkages to Eddy County and the fact that the jobs of some Lea County residents could be tied to the project and some temporary residents may seek temporary housing in Hobbs or elsewhere in Lea County.

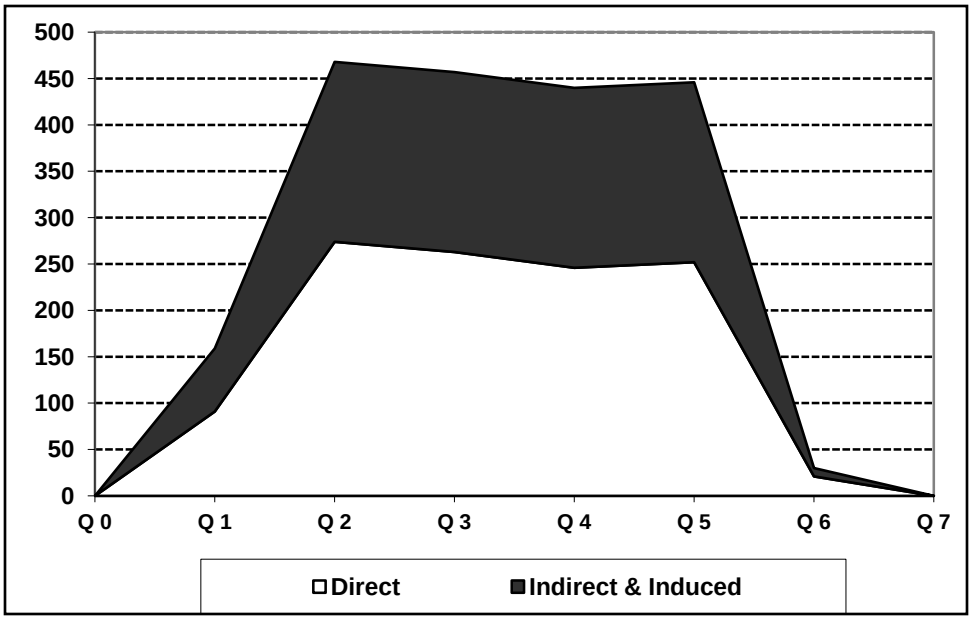


Figure 4.15-2 Total Temporary Employment Effects Associated With the HB In-Situ Project

Table 4.15-1 Total Employment Effects of the Proposed Action

	Initial Construction (approximately 3 months)	Extended Construction (approximately 12 months)	Long-term Operations (28 years)
Project Direct	91	259	36
Indirect and Induced [1]	68	194	19
Total New Jobs Supported	179	453	55

[1] Indirect and induced job multipliers are 0.75 per direct construction job and 0.54 per direct operations job, per IMPLAN model for Eddy County.

Following the completion of construction, the increase in operational employment at Intrepid would support an estimated 19 indirect and induced jobs elsewhere in the economy. The net result would be a net long-term beneficial effect of 55 jobs.

A relatively few direct and indirect jobs would be supported during final reclamation following the completion of production.

Construction and operations of the HB In-Situ Solution Mine Project would have a minor, but beneficial effect on local labor markets, increasing the number of job opportunities for residents and reducing unemployment. At the time of this assessment (third quarter of 2010) local unemployment was high and the local labor force included many skilled workers and candidates due to the relatively large size and established nature of the construction and mining industries in the economy. Consequently, current residents of the area, along with current residents of nearby Lea County who would commute and some non-local workers temporarily employed on other projects, are expected to fill the majority of the jobs supported by the Project. However, some jobs require specialized skills that may be filled by nonlocal workers. Additionally the availability of jobs would attract non-local applicants despite a high relative availability of local labor. Considering these factors, this assessment estimates that up to 53 jobs might be filled by non-local workers during the first quarter of construction activity, with that number increasing to 152 during the subsequent 12 months. Residents are expected to fill a higher share of the long-term jobs, resulting in 12 new workers in the local labor force (see **Table 4.15-2**).

Table 4.15-2 Residency Status of Workers Filling Temporary Jobs Associated with the Proposed Action

	Initial Construction (approximately 3 months)	Extended Construction (approximately 12 months)	Long-term Operations (28 years)
Total New Jobs Supported	159	453	55
Jobs Filled by Residents and Commuters [1]	106	302	43
Jobs Filled by In-migrating Workers	53	152	12

[1] Local residents and commuters are assumed to fill between 60 and 80 percent of the direct, indirect, and induced jobs supported by the proposed project.

The Proposed Action would result in beneficial short-term and long-term increases in personal income in the region. Jobs in the construction and mining industries are among the highest paying jobs in the local economy, thereby contributing to enhanced economic welfare for the directly affected households. The short-term direct increases, consisting of wages, salaries, and the value of benefits paid to construction workers are estimated at approximately $29.2 million; the majority accruing to local residents. Although much of the income accruing to non-residents would leave the region, the local economy would benefit from local purchases of goods and services made by non-local workers during their time of local tenancy. Personal income associated with the indirect and induced jobs supported by the construction phase of the project would contribute an estimated $9.3 million, resulting in a net increase of $38.5 million in personal income.

Small decreases in local farm and ranch income could result in conjunction with reductions in grazing associated with surface disturbance and changes in land use; such declines affecting a single or a few operators. Limited adverse effect on personal income could also result from project-related reductions in outdoor recreation, although it is possible that such activity would continue to occur but be displaced to other locations. The gains in personal income associated with the Proposed Action would greatly offset these declines on a net basis.

Long-term gains in labor income associated with operations of the HB In-Situ Project are estimated at $3.8 million per year, extending over the 28-year life of the project. Reclamation would generate additional short-term income in the future.

Implementation of the Proposed Action also would generate other short- and long-term economic benefits in the form of business revenues and profits, returns to shareholders of corporate entities, public sector revenues, investments in real estate and other infrastructure. The value of some of these benefits will extend beyond the life of the project.

Implementation of the Proposed Action would have limited and localized long-term adverse effects on grazing, OHV riding and hunting, marginally reducing the county-wide economic contributions associated with those activities. Furthermore, rather than resulting in a reduction in use, OHV riding and hunting may be displaced to other areas within Eddy County. The scale of these effects would be small in comparison to the economic benefits associated with the project.

Under the Proposed Action, oil and gas development within the project area would continue to be managed in accordance with the restrictions and requirements of 1986 Order (*Federal Register* 1986) and OCC Order R-111-P. This would mean that access to fluid minerals within the potash leases may require directional or horizontal drilling to extract from the formations under the potash-bearing strata. If the acreage of Intrepid's potash leases were expanded, there may be a greater area where directional or horizontal drilling would be necessary. Because this is an existing practice in the SPA, the employment, income, economic activity and tax and royalty revenue associated with oil and gas development and production would be similar to that described for the No Action Alternative, with the timing predicated on oil and gas prices and other factors satisfying the criteria to support such investment. An economic analysis of the jobs, income and tax revenues associated with Proposed Action, contrasted with those associated with oil and gas development, is beyond the scope of this assessment. The Proposed Action would not preclude oil and gas development.

Adverse effects on other sectors of the economy are not anticipated to arise in conjunction with the Proposed Action.

The economic infusion into the local economy associated with the Proposed Action represent long-term benefits of the project, contributing to the economic welfare of the region. The scale of these benefits would be minor in relation to the overall size of the regional economy.

4.15.5.2 Population and Demographics

A short-term population influx would occur in conjunction with work force migration to fill temporary direct, indirect, and induced job opportunities supported under the Proposed Action. The majority of nonlocal construction workers would be single status, although some workers may be accompanied by a spouse, partner, or families. Due to the temporary nature of the construction jobs under the Proposed Action, the number of families migrating into the area would be low, as would the number of school-age children.

The temporary population influx is estimated at up to 73 individuals during the first quarter of construction, climbing to a peak of 221 persons and an average of 210 persons during the subsequent 12 months of relatively stable activity, declining to 24 as construction is completed and the project transitions to long-term operation (**Table 4.15-3**). Some of the temporary workers may secure long-term jobs allowing them to remain in the region, but most would return to their permanent residence, or move on to another project when the project is completed.

Table 4.15-3 Short-Term Demographic Effects Associated with the Proposed Action

	Initial Construction (approximately 3 months)	Extended Construction (approximately 12 months)	Long-term Operations (28 years)
Jobs Filled by In-migrating Workers	53	152	12
Short-term Population Influx	73	210	24
School-age children	<5	8 to 10	4 to 6

The number of school-age children that entering local schools as a result of the Proposed Action is estimated at 10 or fewer during the construction period. Based on the proposed development schedule, some of those students could be mid-year transfers who then remain for a short period, i.e., through the end of the school year. The projected long-term population increment associated with implementation of Proposed Action is 24, 4 to 6 of whom could be school-age children.

Based on the 28-year production life of the project, some of the residents who migrate to the area to take production jobs may later choose to remain in the region following the cessation of production associated with the Proposed Action.

4.15.5.3 Housing

Based on the employment and population assessments described above, the Proposed Action would create demand for an estimated peak of 140 units and an average of 128 housing units for the 12-month period currently anticipated to begin in the fourth quarter of 2011. Approximately 59 percent of the average demand (75 units) would be associated with non-local single-status construction workers who temporarily migrate to the area. This demand is likely to be accommodated in hotels, motels, and RV parks, primarily in Carlsbad. The remaining incremental demand would be associated with construction workers who would expect to be on site throughout much of the overall construction period, for instance, construction management personnel or workers relocating to the area to accept indirect or induced jobs, and who are more likely to seek conventional housing such as single family rental homes or apartments.

Motel and RV park proprietors and other landlords would benefit from the Proposed Action-related demand, especially during seasonal periods of low tourism demand. Conversely, construction workers may compete with tourism and recreation visitors for temporary accommodations during peak tourism visitation months.

Some non-local workers also may seek housing in other communities such as Artesia, Loving, and Hobbs, but the number of such workers is anticipated to be relatively small based on the distribution of Intrepid's current work force (over 87 percent currently live in Carlsbad) and competition for housing from other sources, especially in Artesia.

Beginning in the sixth quarter of construction, total project-related demand would decline, eventually stabilizing at 10 conventional housing units. Even though moderate-priced conventional housing is in limited supply in Carlsbad, most workers should be able to secure housing over time given the relatively small number of units required and the relatively high wages associated with potash employment.

4.15.5.4 Public Infrastructure, Services, and Local Government Fiscal Conditions

Foreseeable effects on local government infrastructure and services are likely to be minimal given the estimated short- and long-term population influxes; a peak of approximately 221 temporary residents during the construction phase and an estimated 24 residents over the long term. Most temporary nonlocal workers would stay in existing temporary or conventional housing, which is already served by water, wastewater, and other utility infrastructure. The traffic and industrial activity associated with construction of the project may generate additional demand for Eddy County law enforcement, emergency response, and emergency medical services, but given the current level of mining and oil and gas activity near the project area, the incremental demand is anticipated to be relatively minor and similar in nature to existing demand.

The initial capital investment in facilities and equipment, ongoing value of that investment over time, other purchases of goods and services by Intrepid, its work force and that employed by its contractors, and sale of products associated with the Proposed Action would generate a series of one-time and recurrent revenues for the federal, state and local governments. These revenues would help sustain the existing fiscal structure of local public service providers.

The major revenue sources associated with the Proposed Action would include federal mineral royalties on the value of production and local ad valorem (property) taxes on the value of production and mining equipment and facilities. The state will realize an incremental gain in severance taxes, as well as deriving GRTs on the taxable value of goods and service purchases supported by the construction and operations of the Proposed Action. Local governments also would benefit from the increase in GRT.

- Federal mineral royalties: These royalties are determined by terms of specific lease agreements covering the mined area, resource grade/quality, and the value of production. Intrepid estimated the applicable average royalty rate for the Proposed Action at 4.2 percent. Implementation of the Proposed Action would yield average annual federal mineral royalties of between $2.3 million and $4.7 million, based on anticipated average annual sales of 185,000 tpy and historical range in sales price of $300 to $600 per ton. Taxable values are a function of both production and commodity prices and therefore subject to substantial year-to-year fluctuation (New Mexico Taxation and Revenue Department 2009; New Mexico Department of Finance and Administration 2009). The federal government would retain just over half (51 percent) of the receipts, the remainder would be disbursed to the state. The funds received by the state accrue primarily to the general fund, with subsequent disbursements to public education and other programs.
- New Mexico severance tax: Receipts are based on an initial assessment rate of 33.33 percent, from which royalties and a 50 percent standard deduction are subtracted, the residual being the taxable value, to which a tax rate of 2.5 percent is applied. The incremental receipts of severance taxes, based on anticipated production and range of market values, are between $172,975 and $345,950, over the long-term operational life of the project (Intrepid 2009). Severance tax receipts are first used for debt service on bonds issued by the state, with any remainder accruing to the severance tax permanent fund.

- Local ad valorem/property taxes: Assuming a taxable value of 50 percent of gross revenues from previous year's sales and a tax rate of 0.019, implementation of the Proposed Action is projected to yield between $0.53 million and $1.05 million annually, based on anticipated production and range of market values. Additional revenues would be derived on assessments on mining equipment and facilities, as well as off-site real estate improvements elsewhere in the community that are indirectly supported by the project.
- Gross receipts taxes: The GRT is levied on business receipts from sales and leases of most goods, property, and services. The combined tax rate in Eddy County, including local option taxes levied by the county and municipality and the state levy of 5.125 percent, ranges from 5.75 percent to 7.4375 percent. (New Mexico Taxation and Revenue Department 2009). Intrepid has secured Industrial Revenue Bonds through Eddy County that would qualify up to $60 million in qualified capital equipment from GRT. GRT would be generated on capital outlays in excess of that amount, as well as ongoing purchases during operations, and purchases made by individuals employed by contractors, Intrepid and other local businesses and public sector entities in conjunction with the Proposed Action. Due to the many factors underlying the local accrual of GRT, such receipts are not estimated as part of this assessment, though they are likely to be substantial. An economic impact analysis of the proposed project, prepared by the Office of Policy Analysis at New Mexico State University, estimated statewide project-related GRT of between $5.2 million and $6.2 million, over the life of the project (Peach et al. 2011).
- Personal and corporate income taxes: Construction and operation of the Proposed Action would generate estimated incremental personal and corporate income taxes of as much as $3.6 million over the life of the project (Peach et al. 2011).
- Federal payments in lieu of taxes: Implementation of the Proposed Action would have no or little affect on federal PILT, as it would not affect the acreage of federally managed land in the area; such acreage being a primarily determination of annual PILT.

Public service demands associated with the short-term and long-term population growth, jobs, housing, and other factors related to the Proposed Action would result in incremental pressures on public sector expenditures. Although not quantified in this assessment, the scale of the incremental short- and long-term demands associated with the proposed HB In-Situ Solution Mine Project would be limited. Consequently, from a fiscal perspective, implementation of the Proposed Action is likely to be beneficial, both in the short term and over the long term.

4.15.5.5 Social Organization and Conditions

Eddy County and its communities are familiar with natural resource development including potash mining, oil and gas development, construction projects and temporary work forces associated with such development. Consequently, construction of the project and the presence of the moderately sized construction work force are unlikely to result in social disruption in nearby communities. Given the letters submitted in support of the project by area economic development organizations and the City of Carlsbad during scoping and the fact that the Eddy County Commission approved industrial revenue bonds for the project, it is reasonable to assume that the project has broad local support. For many residents, the Proposed Action-related economic activity would likely be welcomed in wake of the recent economic malaise.

However, certain individuals and groups who have the potential to be adversely affected by the Proposed Action may be dissatisfied with the issuance of a ROW. These would include the few affected grazing operators, current recreation users of the area, and oil and gas operators with existing wells or development interests in the project area.

Affected grazing operators could be dissatisfied with the long-term reduction in AUMs related to disturbance, the need for more active livestock management, and potential for damage to grazing improvements, long-term reductions in forage and effects on water resources associated with

groundwater pumping, increase in noxious and invasive weed species, and additional vehicle/livestock collisions associated with Proposed Action-related traffic (see Section 4.7, Rangelands and Livestock Grazing). Note that only one grazing allotment would lose more than 1 percent of totally permitted AUMs under the Proposed Action, and that allotment would lose about 4 percent. The mitigation measure suggested in Section 4.7, coupled with the applicant-committed environmental protection measures described in Section 2.4.5 and the range related BLM environmental requirements included in **Table 2-9** could help avoid or reduce some grazing operator dissatisfaction.

Hunters who currently use the project area and adjacent areas would likely be dissatisfied with the reduction in game associated with the Proposed Action and with the change in the recreational setting. Some hunter displacement may occur during project construction and to a lesser extent during project operations. OHV users who frequent the area, including the Hackberry Lake SRMA, may be dissatisfied with the industrial activity's traffic and overall impact on recreation setting, and safety concerns associated with subsidence and aboveground pipelines crossing RV trails. These effects would occur in a limited portion of the SRMA and, except for potential subsidence effects and aboveground pipelines, would be more prevalent during project construction.

The applicant-committed environmental protection measures described in Section 2.4.5 and the range related BLM environmental requirements included in **Table 2-9** could help reduce some dissatisfaction among recreation users of the project area.

Oil and gas operators with interests in the project area may be dissatisfied with the issuance of a ROW for the Proposed Action because it would generate concern about the effects of solution mining on abandoned and operating wells within the project area.

Collapses of cavern domes and the appearance of sinkholes in the Carlsbad area in recent years have given rise to increased local awareness and concern for subsidence associated with the operation of brine wells in the area. A number of scoping comments expressed concern for potential subsidence resulting from the Proposed Action and this concern may be heightened by issuance of a ROW for the Proposed Action. These concerns may be reduced by the implementation of the Applicant-committed subsidence monitoring plan described in Section 2.4.5 of this EIS.

4.15.5.6 Environmental Justice

Implementation of the Proposed Action would not be anticipated to result in significant adverse impacts to human health and environmental resources, nor would it have disproportionately high effects on minority or low-income populations in the region. Consequently, environmental justice concerns would not arise in conjunction with the Proposed Action.

4.15.6 Alternative B

Implementation of Alternative B, when compared to the Proposed Action, would require a slightly larger construction work force and additional capital investment to upgrade and install new water transmission pipelines to provide supplemental water from the Caprock Formation. The water pipeline work would be accomplished by a work force of approximately 13 workers over a 13- to 15-month period; with the additional work occurring concurrently with other construction activities, leaving the overall 14- to 18-month construction schedule unaffected. Projected long-term operations of the HB In-Situ Solution Mine Project under Alternative B would be the same as with the Proposed Action, encompassing 28 years of filling, solution withdrawal, evaporation and mineral precipitation, and final product processing and sales. Intrepid's incremental operational work force needs are estimated at 36 employees, the same as under the Proposed Action. Final reclamation activities would follow the conclusion of processing.

4.15.6.1 Economic Effects

Alternative B would result in slightly higher short-term employment and income effects than would occur with the Proposed Action, the differences due to the larger number of construction workers directly employed during the first through fifth quarters of construction (**Figure 4.15-3**). Intrepid's capital investment also would be higher than for the Proposed Action.

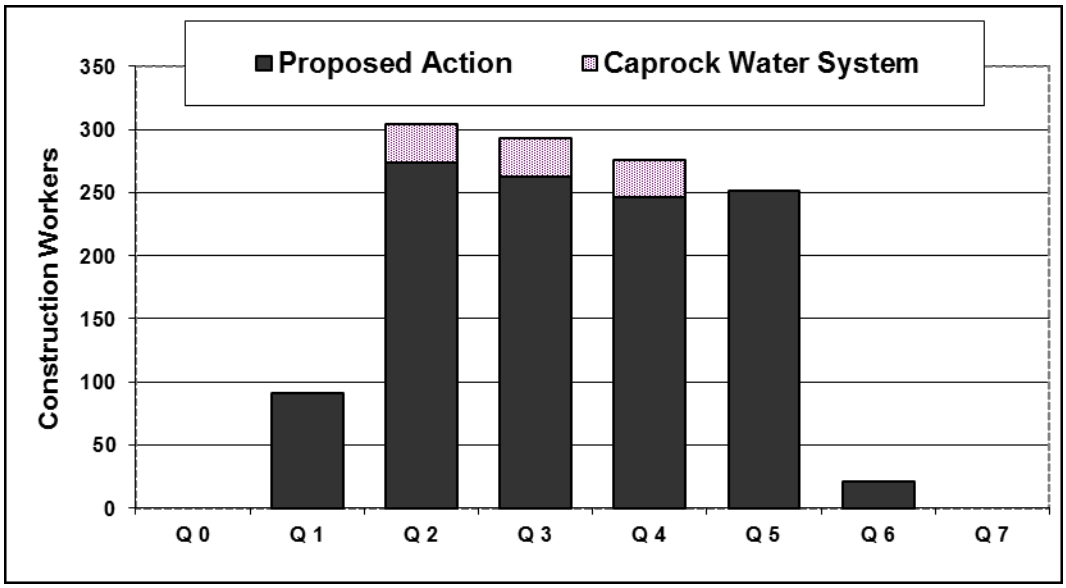


Figure 4.15-3 HB In-Situ Project Estimated Direct Construction Jobs—Alternative B

The short-term employment of 13 additional construction workers would support 10 additional indirect and induced jobs in the region, yielding an estimated average impact of 473, 23 higher than under the Proposed Action. The majority of the indirect and induced jobs would be based in Eddy County, although Lea County could realize incremental benefits associated with project-related spending by the temporary work force.

Alternative B would directly and indirectly generate an estimated $40.6 million in personal income during the 14- to 18-month construction period, approximately $2.1 million more than with the Proposed Action. The gains in personal income would represent short-term, benefits in the region. Motels, restaurants and cafes and other businesses catering to tourists and other visitors would realize increases in sales under Alternative B, the net magnitude of which would be slightly higher than under the Proposed Action.

The temporary jobs in construction and other industries supported by that activity would result in short-term, minor improvement in labor markets. Unemployment could decrease slightly for a short period.

The long-term direct, indirect, and induced economic effects associated with production under Alternative B would be comparable to those under the Proposed Action.

Implementation of Alternative B would have very limited adverse effects on grazing, recreation, and hunting, reducing the economic contributions associated with the activities. The magnitude of these effects would be comparable to those under the Proposed Action.

Oil and gas development within the project area would continue in accordance with the restrictions and requirements of the Secretary's Potash Order (*Federal Register* 1986) and OCC Order R-111-P.

Groundwater modeling completed for this assessment indicates a potential for groundwater drawdown in the portion of the Ogallala aquifer that supplies municipal water for the town of Lovington in Lea County. The extent, magnitude, timing, and potential economic implications of drawdowns on the community are uncertain, and that uncertainty represents a risk of potentially significant adverse economic effects not present under the Proposed Action. Also uncertain is the persistence of the drawdown and related effects after pumping ceases, although it is conceivable that the effects would extend beyond the life of project.

4.15.6.2 Population

Short-term population increases in Eddy County would be slightly higher under Alternative B, as compared to the Proposed Action, due to the higher number of construction workers employed directly on the project and an incremental increase in indirect and induced employment. Under Alternative B, the temporary influx of workers to fill the available jobs would result in an estimated pea k short-term population increase of 233 individuals, 12 higher than under the Proposed Action. Unaccompanied, single-status construction workers would account for much of the population increase, arriving in the area to work on the project, returning to their permanent residence when the project is completed.

Some of the in-migrating workers would be accompanied by spouses or partners, some of whom may be employed on the project as well or find other temporary jobs in the community.

Due to the temporary nature of the construction jobs under Alternative B, the number of families migrating into the area would be low. Consequently, few school age children would be among the migrating population.

The projected long-term population increment associated with implementation of Alternative B is 29, 4 to 6 of whom would be school-age children, the same as under the Proposed Action. Based on the 28 year production life of the project, some of the adult residents among this population would likely remain in the region after the conclusion of production associated with Alternative B.

4.15.6.3 Housing

Implementation of Alternative B would result in temporary demands on motels, hotels, RV parks, apartments, and rental housing in the area. Total peak needs are estimated at 147 units, 7 more than under the Proposed Action. The additional need would result in more pressure on the available supply in Carlsbad, marginally increasing the potential that some workers would find it necessary to secure temporary housing in other nearby communities and endure longer daily commutes. The short-term demands associated with Alternative B are reasonably comparable to those under the Proposed Action but would create additional competition with seasonal demands associated with tourism and recreation.

Long-term housing demand for 10 units of conventional single and multi-family housing associated with Alternative B would be the same as under the Proposed Action. That level of demand can be met from within the existing housing supply, augmented by the capacity of the residential construction industry to develop new housing.

4.15.6.4 Public Infrastructure, Services, and Local Government Fiscal Conditions

As with the Proposed Action, Alternative B-related effects on local government infrastructure and services are likely to be minimal given the relatively small estimated short and long-term population influxes. Construction workers associated with Alternative B are assumed to be housed in existing temporary and conventional housing units, which are currently served by utilities and should be accommodated with existing capacity. Demands associated with operations workers under Alternative B would be the same as the Proposed Action.

The traffic and industrial activity associated with Alternative B construction activities would be slightly greater and distributed over a somewhat broader area than that associated with the Proposed Action, resulting in the potential for additional demand for Eddy County law enforcement, emergency response and emergency medical services as compared to the Proposed Action, but the incremental demand would be anticipated to be relatively minor and similar in nature to existing demand.

Short and long-term fiscal effects associated with implementation of Alternative B would be largely comparable to those under the Proposed Action. In the short-term, GRT and personal and corporate income taxes would be slightly higher due to the increases in capital investment, higher labor income, and additional taxable purchases of goods and services by construction workers associated with the project. Public expenditures that are sensitive to seasonal and other short-term demand, for instance, some local law enforcement services, may be higher under Alternative B than under the Proposed Action. Many public facilities and services, however, would either be unaffected or unable to distinguish the demands from other seasonal influences or year-to-year variations in demand. The net fiscal effects would be minor due to the temporary nature and limited scale of the demand and revenue flows.

Because Alternative B leaves projected production and life of the project unaffected, long-term tax revenues such as federal mineral royalties that are tied to production levels and value of output under Alternative B would be comparable to those under the Proposed Action. Alternative B would yield slightly higher local ad valorem/property taxes due to the higher capital investment associated with the development of an alternative water source. Those differences would extend over the operational life of the project.

4.15.6.5 Social Organization and Conditions

Effects of Alternative B on social organization and conditions within the project area would be similar to those associated with the Proposed Action, with the exception that the forecast groundwater drawdown over a larger area is likely to raise concerns among additional individuals, groups, and organization about the potential environmental effects of such drawdown.

4.15.6.6 Environmental Justice

Implementation of Alternative B would not be anticipated to result in any disproportionately high adverse human health and environmental effects on minority or low-income populations in the region. Consequently, environmental justice concerns would not arise in conjunction with Alternative B.

4.15.7 Alternative C

Implementation of Alternative C would employ a slightly larger construction work force over a period of several months to bury existing and newly built water transmission pipelines that would be used to fill and withdraw water from the mine workings. Burial of the pipelines would occur with the same time frame as the other project development activities, leaving the overall 14- to 18-month construction schedule unaffected. Long-term operations of the HB In-Situ Solution Mine Project would encompass 28 years of filling, solution withdrawal, evaporation and mineral precipitation, and final product processing and sales. Intrepid's incremental operational work force needs are estimated at 36 employees, the same as under the Proposed Action. Final reclamation activities would follow the conclusion of processing.

4.15.7.1 Economic Effects

Alternative C would result in slightly higher temporary employment and income effects than would occur with the Proposed Action, the differences due to the slightly larger number of construction workers directly employed during the second and third quarters of construction. Intrepid's total capital investment also would be slightly higher than for the Proposed Action.

The short-term employment of additional construction workers would support a few additional indirect and induced jobs in the region. The majority of the indirect and induced jobs would be based in Eddy County.

Alternative C would directly and indirectly generate slightly higher personal income during the 14- to 18-month construction period, than would result from the Proposed Action. The gains in personal income would represent short-term, benefits in the region. Motels, restaurants and cafes and other businesses catering to tourists and other visitors would realize increases in sales under Alternative C, the net magnitude of which would be slightly above those under the Proposed Action.

The temporary jobs in construction and other industries supported by that activity would result in short-term, minor improvement in labor markets. Unemployment would decrease slightly for a short period.

The long-term direct, indirect, and induced economic effects associated with production under Alternative C would be the same as those under the Proposed Action.

Oil and gas development within the project area would continue in accordance with the restrictions and requirements of the Secretary's Potash Order (*Federal Register* 1986) and OCC Order R-111-P.

Implementation of Alternative C would have fewer adverse effects on grazing and OHV riding as compared to the Proposed Action because the buried pipelines would remove obstacles for livestock movement and obstacles and safety concerns for OHV riders, consequently the economic effects of Alternative C on these activities would likely be somewhat less adverse as compared to those associated with the Proposed Action. Economic effects of Alternative C on hunting would be comparable to those under the Proposed Action.

4.15.7.2 Population and Demographics

The short-term population increases in Eddy County would be slightly higher under Alternative C, as compared to the Proposed Action, but lower than under Alternative B.

The projected long-term population increment associated with implementation of Alternative C is 29, 4 to 6 of whom would be school-age children, the same as under the Proposed Action. Based on the 28-year production life of the Project, some of the adult residents among this population would likely remain in the region after the conclusion of production associated with Alternative C.

4.15.7.3 Housing

Implementation of Alternative C would result in temporary demand on motels, hotels, RV parks, apartments, and rental housing in the area. The average demand on temporary housing under Alternative C would be slightly higher than with the Proposed Action, but peak demand would be the same because the incremental need would occur in the second and third quarters of construction, prior to the peak. The incremental need would marginally increase the potential of some workers finding it necessary to secure temporary housing in other nearby communities. The short-term demands associated with Alternative C could compete with seasonal demands associated with tourism and recreation, in the same manner as would the Proposed Action.

Long-term housing demand under Alternative C would be the same as under the Proposed Action. That level of demand can be met from within the existing housing supply, augmented by the capacity of the residential construction industry to develop new housing.

4.15.7.4 Public Infrastructure, Services, and Local Government Fiscal Conditions

As with the Proposed Action, Alternative C-related effects on local government infrastructure and services are likely to be minimal, given the estimated short and long-term population influxes.

Construction workers associated with Alternative C are assumed to be housed in existing temporary and conventional housing units, which are currently served by utilities and should be accommodated with existing capacity. Demands associated with operations workers under Alternative C would be the same as the Proposed Action.

The traffic and industrial activity associated with Alternative C construction activities would be slightly greater but occur within the same area as that associated with the Proposed Action, resulting in comparable additional demands on Eddy County law enforcement, emergency response, and emergency medical services as the Proposed Action. The incremental demand would be anticipated to be relatively minor and similar in nature to existing demand.

Short and long-term fiscal effects associated with implementation of Alternative C would be essentially the same as those under the Proposed Action. In the short-term, GRT and personal and corporate income taxes would be slightly higher due to the increases in taxable purchases of goods and services by construction workers associated with the project. Most public facilities and services would either be unaffected or unable to distinguish the demands from other seasonal influences or year-to-year variations in demand. The net fiscal effects would be very limited due to the temporary nature and scale of the demand and revenue flows.

Alternative C leaves projected production and life of the project unaffected. The capital investment also would be largely unaffected. As a result long-term tax revenues over the life of the project would be the same under Alternative C as under the Proposed Action.

4.15.7.5 Social Organization and Conditions

Effects of Alternative C on social organization and conditions within the project area would be similar to those associated with the Proposed Action, with the exception that concerns of grazing operators and OHV users about the effects of aboveground pipelines on their activities would be eliminated.

4.15.7.6 Environmental Justice

Implementation of Alternative C would not be anticipated to result in any disproportionately high adverse human health and environmental effects on minority or low-income populations in the region. Consequently, environmental justice concerns would not arise in conjunction with Alternative C.

4.15.8 Alternative D—Preferred Alternative

Implementation of the Preferred Alternative would occur over a 20- to 24-month timetable, 6- to 9-months longer than the Proposed Action. Intrepid estimates additional investment of $190 million to $200 million to implement the Preferred Alternative. Relocation of existing power, natural gas, and fiber optic lines, development of evaporation ponds, construction of a new mill, and work to put additional water pumps, transmission lines and other support facilities in place will support short-term construction related jobs in the local economy, both directly and indirectly. Project timetable and direct employment estimates provided by Intrepid call for initial construction activity in the first quarter of 2012, employing up to 74 construction workers.[2]

Thereafter direct employment would increase to a peak of 272 jobs in the first quarter of 2013, primarily in conjunction with construction of the new mill and evaporation ponds. Construction employment would remain at approximately 175 workers through the third quarter of 2013 until construction is substantially

[2] Assuming a Record of Decision and permit to proceed by mid-first quarter 2012.

completed, declining to about 20 jobs to finalize completion of the evaporation ponds (**Figure 4.15-4**) (Intrepid Potash Inc. 2011).[3]

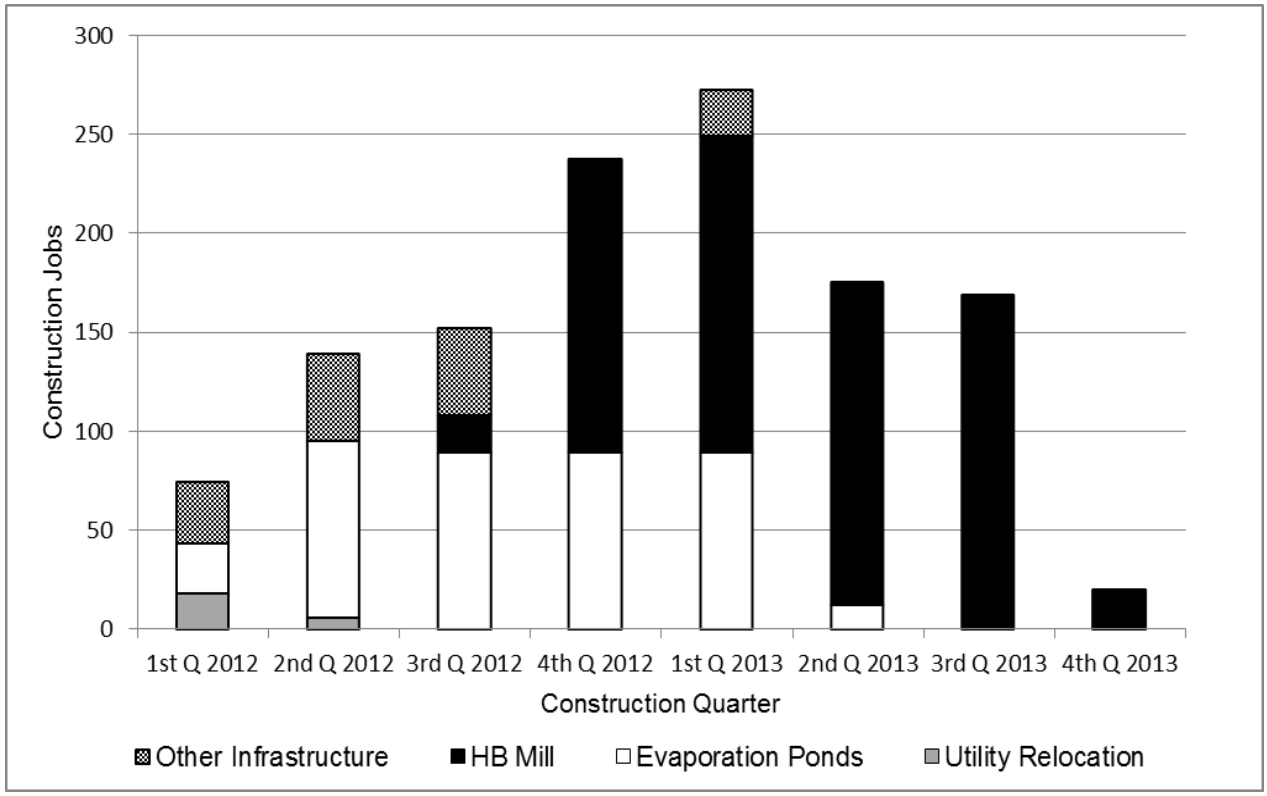


Figure 4.15-4 HB In-Situ Project Estimated Direct Construction Jobs for the Preferred Alternative

Ongoing production costs for the in-situ project are estimated at $11.4 million to $13.9 million during a typical year. Long-term operations of the HB In-Situ Solution Mine Project would encompass 28 years of filling, solution withdrawal, evaporation and mineral precipitation, and final product processing and sales. Intrepid's incremental operational work force needs are estimated at 36 employees, the same as under the other action alternatives.

4.15.8.1 Economic Effects

The Preferred Alternative would require a higher level of temporary construction labor to complete, as compared to the Proposed Action, thereby supporting more temporary indirect and induced employment in the region. The increase would result primarily from the longer period of construction, rather than an increase in the peak or average number of jobs indirectly supported.

The overall short-term stimulus associated with the Preferred Alternative would be 130 jobs during the initial quarter of construction activity; averaging 334 jobs over the subsequent 18 months of construction

[3] Further perspectives on the potential economic impacts associated with the proposed project can be found in "The Economic Impacts of Intrepid Potash, Inc.'s Proposed HB Solar Solution Mine Project in Eddy County, New Mexico", 2011. The report was prepared by J. Peach, et al, at the Arrowhead Center, New Mexico State University under contract to Intrepid Potash, Inc.

activity, and with a short term peak of up to 476 jobs in the first quarter of 2013 (see **Figure 4.15-5** and **Table 4.15-4**). The majority of these jobs would be based in Eddy County, although Lea County would likely realize benefits from the jobs based on economic linkages to Eddy County and the fact that some temporary residents may seek temporary housing in Hobbs or elsewhere in Lea County.

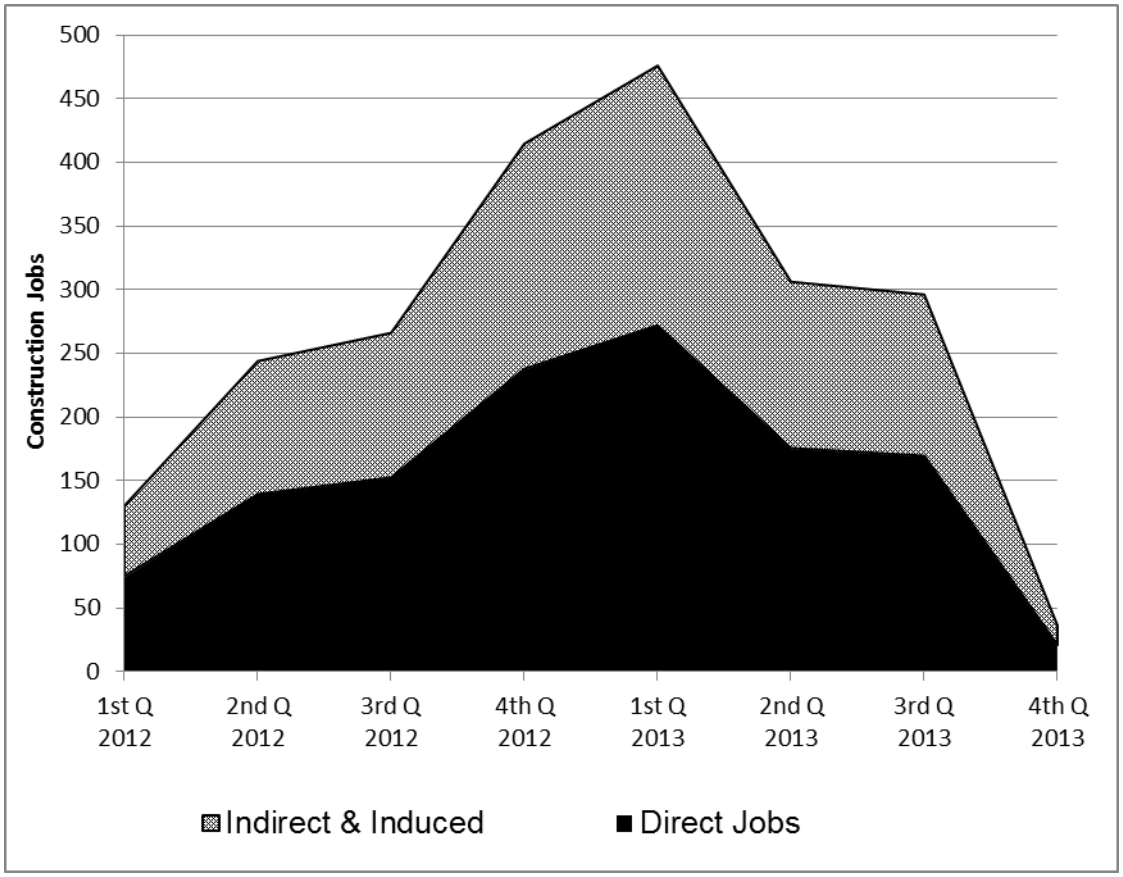


Figure 4.15-5 Total Temporary Employment Effects Associated With the Preferred Alternative

Table 4.15-4 Total Employment Effects of the Preferred Alternative

	Initial Construction (1st Q/2012)	Average (2nd Q/ 2012 - 3rd Q/2013)	Peak Quarter (1st Q/2013)	Long-term Operations (28 years)
Project Direct	74	191	272	36
Indirect and Induced [1]	56	143	204	19
Total New Jobs Supported	130	334	476	55

[1] Indirect and induced job multipliers are 0.75 per direct construction job and 0.54 per direct operations job, per IMPLAN model for Eddy County.

Following the completion of construction and transition to operations, the addition of 36 long-term operating jobs at Intrepid under the Preferred Alternative would indirectly support 19 other jobs in the economy, the same number as under the Proposed Action. The net result would be a net long-term beneficial effect of 55 jobs.

Due to the increased area and facilities to be reclaimed, implementation of the Preferred Alternative would likely support a slightly higher level of employment during final reclamation than would result from the Proposed Action.

The peak number of temporary workers migrating to fill jobs under the Preferred Alternative would be slightly higher than under the Proposed Action, 160 compared to 152 workers, however, the average number of jobs over the entire construction period would be lower. Furthermore, the peak quarter is anticipated to occur during the first quarter of the year, as compared to third quarter under the Proposed Action. The difference means less potential competition/conflict between the with the traditional primary tourism season in the region, for example, competition for temporary housing, The resident labor force is expected to allow current residents of the area to fill most of the long-term jobs, resulting in just 12 additional workers in the local labor force (see **Table 4.15-5**).

Table 4.15-5 Residency Status of Workers Filling Temporary Jobs Associated with the Preferred Alternative

	Initial Construction (1st Q/2012)	Average (2nd Q/2012 - 3rd Q/2013)	Peak Quarter (1st Q/2013)	Long-term Operations (28 years)
Total New Jobs Supported	130	334	476	55
Jobs Filled by Residents and Commuters (conservative)[1]	86	222	316	43
Jobs Filled by In-migrating Workers	44	112	160	12

[1] Local residents and commuters are assumed to fill between 60 and 80 percent of the direct, indirect, and induced jobs supported by the proposed project.

The Preferred Alternative would result in beneficial short-term and long-term increases in personal income in the region. The short-term increases, estimated at $47.5 to $50.0 million, would be higher than under the Proposed Action. Although much of the income accruing to non-residents would leave the

region, the local economy would benefit from local purchases of goods and services made by non-local workers during their time of local tenancy.

The long-term increase in personal income extending over the 28-year life of the project would be the same as under the Proposed Action.

Project-related effects on grazing and outdoor recreation would be comparable to those under the Proposed Action. The gains in income associated with the Preferred Alternative would greatly offset these declines on a net basis. Jobs in the construction and mining industries are among the highest paying jobs in the local economy, thereby contributing to enhanced economic welfare for the directly affected households.

As would be true under the Proposed Action, future oil and gas development within the project area under the Preferred Action would continue in accordance with the restrictions and requirements of the Secretary's Potash Order (*Federal Register* 1986) and OCC Order R-111-P.

4.15.8.2 Population and Demographics

The temporary population influx into Eddy County is estimated at up to 58 individuals during the initial quarter of construction, averaging 153 individuals during the subsequent 18 months, with a short term peak of 221 persons. Thereafter, the population gain would decline to 24 as construction is completed and the project transitions to long-term operation (**Table 4.15-6**). Some of the temporary workers may secure long-term jobs allowing them to remain in the region, but most would return to their permanent residence, or move on to another project when the project is completed.

Table 4.15-6 Short-Term Demographic Effects Associated with the Preferred Alternative

	Initial Construction (1st Q/2012)	Average (2nd Q/2012 - 3rd Q/2013)	Peak Quarter (1st Q/2013)	Long-term Operations (28 years)
Jobs Filled by In-migrating Workers	44	112	160	12
Short-term Population Influx	58	153	221	24
School-age children	<5	5 to 8	8 to 10	4 to 6

The number of school-age children entering local schools as a result of the Preferred Alternative is estimated at 10 or fewer during construction, comparable to the potential enrollment increase as under the Proposed Action. Some of those students could be mid-year transfers and remain for a year or less. The projected long-term population increment associated with the Preferred Action would be 4 to 6 school-age children, the same as for the Proposed Action.

4.15.8.3 Housing

Based on the above employment and population assessments above, the Preferred Alternative would create demand for up to 140 housing units in the first quarter of 2013. Most of that demand would be associated with non-local single-status construction workers and likely be accommodated in hotels, motels and RV parks in and near Carlsbad. The remaining incremental demand would be associated with workers such as construction management personnel who relocated with other household members, construction workers who expect to be on site throughout much of the overall construction period, or workers who relocate to the area to accept indirect or induced jobs supported by the project and thus would be more likely to seek conventional housing such as rental homes or apartments.

Long-term housing demand under the Preferred Alternative would be the same as under the Proposed Action. That level of demand could be met from within the existing housing supply, augmented by the capacity of the residential construction industry to develop new housing.

4.15.8.4 Public Infrastructure, Services, and Local Government Fiscal Conditions

Foreseeable effects on local government infrastructure and services under the Preferred Alternative are likely to be minimal given the estimated short- and long-term population influxes to the region. Most public facilities and services would either be unaffected or unable to distinguish the demands from other seasonal influences or year-to-year variations in demand.

The net fiscal effects are expected to be beneficial and long-term due to the temporary nature and limited scale of the incremental demand as compared to the long-term flows of revenues to the state and local governments.

4.15.8.5 Social Organization and Conditions

Effects of Preferred Alternative on social organization and conditions within the project area would be similar to those associated with the Proposed Action, other than that some concerns of grazing operators and OHV users about the effects of aboveground pipelines on their activities would be reduced.

4.15.8.6 Environmental Justice

Environmental justice concerns would not arise in conjunction with the Preferred Alternative.

4.15.9 Summary of Impacts

The continuation of current economic drivers would be anticipated to sustain the region's economy for the foreseeable future, providing a relative high degree of economic vitality and diversity for its residents and a fiscal foundation for local government. Population projections anticipate moderate long-term growth for Eddy County, with net growth of nearly 7,500 residents projected between 2010 and 2035 (UNM-BBER 2008).

Under the Preferred Alternative short term direct employment would increase by an average of 177 jobs in conjunction with construction activities, with a temporary peak of 272 jobs. The temporary jobs in construction and other industries supported by that activity would result in short-term, minor improvement in labor markets. Unemployment would decrease slightly for a short period.

Intrepid's existing operational work force of 629 employees would be expanded by 36 positions for the operational phase of the proposed project. The majority of these jobs would be based in Eddy County. Under the Proposed Action, the increase in operational employment at Intrepid would support an estimated 19 indirect and induced jobs elsewhere in the economy, for a net long-term beneficial effect of 55 jobs. The Preferred Alternative would result in net beneficial short-term and long-term increases in personal income in the region.

A short-term population influx would occur in conjunction with work force migration to fill temporary direct, indirect, and induced job opportunities. Short-term population increases in Eddy County from the Preferred Alternative are estimated at up to 221 individuals. The temporary population gains would create demand on motels, hotels, RV parks, apartments, and rental housing in the area. Total peak demand is estimated at 140 units. Foreseeable effects on local government infrastructure, services, and expenditures are likely to be minimal under the Preferred Alternative.

Implementation of the Preferred Alternative would result in substantial increases in Federal Mineral Royalties, and local ad valorem/property, gross receipts, and personal and corporate income taxes over the life of the project.

Implementation of the Preferred Alternative would not be anticipated to result in significant adverse impacts to human health and environmental resources, and would not have disproportionately high effects on minority or low-income populations in the region. Consequently, environmental justice concerns would not arise.

4.16 Summary of Irreversible and Irretrievable Commitments of Resources

Selection and approval of any of the action alternatives could result in the irreversible commitment of specific resources (e.g., the loss of future options for resource development or management), especially for nonrenewable resources such as minerals or cultural resources. It also would result in the irretrievable commitment of resources, defined as the lost production or use of renewable natural resources during the life of the operations. The irreversible commitment of irretrievable resources for this project is anticipated to be minimal. Those resources that would be affected by irreversible or irretrievable commitments are summarized below.

Geology and Minerals. Approximately 185,000 tons of salable potash is estimated to be produced each year that the evaporation ponds yield marketable precipitate (approximately 26 years). This would result in both irreversible and irretrievable commitments of potash ore.

Groundwater. Groundwater levels affected by proposed pumping operations are predicted to partially recover in the Rustler Formation in the long term. Groundwater recharge would be very slow and unpredictable, but not entirely irreversible. Groundwater levels drawn from the Caprock Aquifer would recover much more quickly, so there would not be an irreversible commitment of that resource. The water lost from the evaporation ponds would result in an irretrievable commitment of groundwater.

Soils. The soils that are excavated to construct project facilities, especially to install pipelines and construct the new HB mill, would be permanently altered because the soil horizons would be mixed. Even after reclamation, soil productivity may return but the excavations would result in irreversible alterations of the natural soils.

Socioeconomics. The economic investment and human effort by employable labor associated with the construction and operation of the proposed project could be considered an irreversible commitment of resources. However, this commitment could be viewed as a positive impact due to the jobs created or maintained in this area that relies on mineral development as a major employer.

Energy. Construction and operation of the proposed project would require the commitment of an irretrievable volume of fuel, diesel fuel and gasoline, as well as fuel to generate electricity for the mill and other required operations.